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CONTENTS

We announced in our issue of November 5, page 853, that we were going to renew our shop kink competition, and we offered a first prize of $50 and a second prize of $25 for the best collection of shop kinks submitted to the *Railroad Age Gazette* on or before December 13, the winning collection to appear in our issue of January 7, 1910. Previous competitors may enter again with a new collection of devices, if they choose to do so. As before, the award will be made on the basis of the best collection of three, four or five kinks, but each competitor may send in as many as he pleases, leaving the judges to make their own selections. Send the original tracings or photographs, if possible; if the tracings are not available, send a blueprint. This is the last call for the December competition.

The collection of shop kinks appearing in the current issue was gathered by George L. Fowler, associate editor of the *Railroad Age Gazette*, from the new shops of the Delaware, Lackawanna & Western, at Scranton. The devices shown are of great interest and ought to prove money savers in a good many shops.

THE FUTURE OF THE FRISCO.

The current news rumor that the St. Louis & San Francisco is likely to be detached from the Rock Island system and added to the Hawley system is of quite unusual interest and importance. Even before the matter is definitely settled one way or the other, it is worth while to note that the suggested plan has much to recommend it, from the standpoint of all three parties at interest. The St. Louis & San Francisco has had a very singular career, having been an oppressive burden to both of the great systems that adopted it; first to the Santa Fe, and then to the Rock Island. But this was not the fault of the St. Louis & San Francisco; it was the fault of the people that took it into the larger systems on a capital basis so high that it would have been little short of miraculous if the Frisco had been profitable to them. The St. Louis & San Francisco occupies the region in Missouri and Arkansas enclosed on two sides by the Mississippi and Missouri rivers, with Kansas City, St. Louis and Memphis as the bounding points. Then it extends southwest through Oklahoma into Texas. The total mileage operated June 30, 1909, was 5,253, of which 1,718 miles is in the state of Missouri; 1,498 miles is in Oklahoma, and 630 miles is in Kansas; while the Chicago & Eastern Illinois, controlled through stock ownership, operates 966 miles additional, of which 692 miles is in Illinois. The characteristic way that most of this mileage was acquired was for the St. Louis & San Francisco to guarantee the bonds of a large number of formerly independent companies, and then gradually to deposit the bonds and stock of these companies as collateral for additional securities of its own. The selections were not always made wisely, and the prices paid were sometimes too high, but the country in which the Frisco operates has had a most extraordinary development, and the promise of most of the component lines is good. The leasehold property, the Kansas City, Memphis & Birmingham, gives the property a direct connection with the Birmingham district and is itself a large earner; the Chicago & Eastern Illinois furnishes a direct line from St. Louis and from the Mississippi crossing at Rock View to Chicago; while the eastern portion of the Chicago & Eastern Illinois lines, in connection with the Evansville & Terre Haute, affords the Louisville & Nashville its direct Chicago connection. It is sometimes forgotten by those who are familiar with the history of the Frisco that it is almost as good an earner as the Rock Island. For the year ending June 30, 1909, the Rock Island earned a little over $7,600 per mile gross, and the Frisco somewhat more than $7,200 per mile, excluding the Chicago & Eastern Illinois, which reports its earnings separately and earned over $10,500 per mile, gross.

The funded debt of the St. Louis & San Francisco, owing to the way in which the property was built up is too heavy, and the road would be greatly benefited by a reorganization which would place its charges well below the capabilities of its large and known earning power, thereby giving the company credit for necessary improvement and betterment work. Even including the weak branch lines, it will not be very many years before the Frisco system, as a whole, earns $10,000 per mile gross, provided it can get credit and secure funds to improve its facilities. As an adjunct to the Hawley system, if it is going to be one, it can be very helpful, and the other lines in the system can be very helpful to it, although it is to a considerable extent a competitor of the Missouri, Kansas & Texas. It is probably safe to say that the Rock Island was of no very great use to the Frisco, and the Frisco is of use to the Rock Island principally through its controlled properties, the Chicago & Eastern Illinois and the Kansas City, Memphis & Birmingham. The Hawley lines, however, are in position to bring the Frisco a good deal of traffic that it does not now get, and the Frisco is in position to route large additional amounts of traffic over the Missouri, Kansas & Texas, the Alton and the Clover Leaf. The Alton and the Chicago & Eastern Illinois are obviously competitors, and the Rock Island needs the Chicago & Eastern Illinois a great deal more than the Frisco does, if the Frisco is to be operated in the Hawley group, which already has the Alton. It may well

be that the Chicago & Eastern Illinois should be detached from the Frisco system and annexed to the Rock Island, from the standpoint of economic efficiency.

THE CONVERTED MALLET LOCOMOTIVE.

The most important development in locomotive practice in the past year is the extensive use of Mallet locomotives on western lines. The largest order for this type of engine has been from the Great Northern, which now has in service 67 of these heavy locomotives. The first experiments on this line were made in 1906 on the Cascade mountain grades, where there are 22 miles of continuous 2.2 per cent. on one side of the tunnel and 32 miles of the same grade on the other side. These Mallet engines proved so successful and showed such remarkable fuel economy as compared with the large consolidation engines previously used in that service that smaller articulated engines were ordered for road service where there are 1 per cent. grades. These proved so economical that in May, 1908, 37 Mallet engines were ordered, it having been decided to extend the use of them to districts having grades as low as .072 per cent.

The large Mallet engines on the Cascade mountain handled on the round trip over the division 1,600 tons with an equivalent consumption of 25.13 lbs. of coal per 100-ton miles, while the consolidation engines could handle a train of only 1,050 tons with practically the same amount of coal, or an equivalent of 38.29 lbs. per 100-ton mile. In other words, the introduction of the Mallet engine resulted in an increased tonnage on this division of 52 per cent., with a saving of 34.4 per cent. coal per 100-ton miles. This performance has been so satisfactory that the Mallets have replaced consolidation engines on that division. The smaller Mallet engines on the division from Spokane to Leavenworth, 197 miles, with a ruling grade in both directions of 1 per cent., have a rating of 1,450 tons, and the consolidation engines a rating of 1,100 tons, giving an increase of 31.8 per cent., and a saving in coal of 27.5 per cent. per ton mile. The introduction of this large number of Mallet engines on the Great Northern has left quite a number of consolidation engines on hand which were previously used in the heaviest freight service.

The recent decision to convert these consolidations into articulated locomotives is one of the most surprising and far-reaching movements in locomotive practice ever witnessed in this country. The Great Northern is receiving from the Baldwin Works the front engine with compound cylinders, which is intended to be coupled to one of the old consolidation engines we have already referred to, and the combination will be what we have termed a "Converted Mallet Locomotive." The firebox, boiler, cylinder and running gear of the consolidation remain the same. The Emerson superheater will be fitted to the smokebox and the new boiler shell of the front engine will be fastened to it. This new shell will not have any direct evaporating surface, but will be filled with tubes and used as a feed-water heater, thus utilizing a portion of the heat from the waste gases which passed out of the stack of the simple engine. The compound cylinders in slow freight service will produce some additional saving in steam and fuel, so that the total economy of the complete locomotive will be such that it is expected that the grate surface and heating surface of the original simple consolidation engine will be sufficient to furnish steam for the larger and heavier articulated engine.

The cylinders of the consolidation engines are 22 x 30 in.; driving wheels, 55 in.; weight on drivers, 180,000 lbs.; total heating surface, 2,768 sq. ft.; grate area, 59.2 sq. ft. The large Mallet engines on the Great Northern have horse-power cylinders 21½ x 32 in., a heating surface of 5,700 sq. ft. and a grate area of 78 sq. ft., while the Mallet engines for ordinary road service have high-pressure cylinders 20 x 30 in., heating surface of 39.14 sq. ft. and a grate area of 53 sq. ft. The converted Mallet locomotive will have the same cylinders, heating surface and grate area as the old consolidation, and while it may be said that the heating surface and grate area should now be sufficient to supply the same high-pressure cylinders as before, yet the new converted locomotive will be much larger and heavier, with more weight on drivers and greater tractive power, so that whatever additional heat is absorbed by the engines must be derived from the superior economy of the compound cylinders from the advantage of the superheater and the saving due to the feed-water heater.

The high-pressure cylinders and grate area of the smaller Mallets on the Great Northern are smaller than those of the consolidations, but the tonnage rating has been increased nearly 32 per cent., and a fuel saving on the ton-mile basis of 27 per cent. is obtained on the divisions having 1 per cent. grades. A large proportion of this saving in fuel must be attributed to the economy of the compound cylinders. This economy is not as great with the smaller Mallets on the Spokane division, because the speed is much faster than that on the Cascade division and often as high as 30 miles per hour on the lower grade district. The saving of 34 per cent. fuel was obtained on the 2.2 per cent. grades, where the speed was necessarily very slow. The advantage to be derived from the superheater in fuel economy can be taken as 15 to 20 per cent. Recent tests on the Santa Fe show that the latter figure has been obtained, but it is probable that a portion of this saving is due to the arrangement of the draft rigging, which dispenses with the baffle plate and permits of the use of large exhaust nozzles and reduces the loss from unconsumed fuel discharged through the stack. The economy of feed-water heaters for locomotives has been frequently demonstrated, and the smaller ones which have been used on the ordinary simple locomotives have usually given a good account of themselves. The larger superheater which it is possible to use in the boiler shell of the Mallet locomotive must exceed in efficiency any type which has been previously used. It has already been demonstrated on the Santa Fe that 5 or 6 ft. of the front end of the long tubes used with large freight locomotives can be profitably removed and their places occupied by superheaters and feed-water heaters. A boiler so constructed is now being tested at Topeka under conditions where the separate economy of each device can be accurately measured, and when these tests are completed we hope to be able to present some data showing what economy can be expected from large feed-water heaters in locomotive practice.

It can be seen that the introduction of the converted Mallet locomotive, as above described, involves some new questions of proportions of cylinders and heating surface, the efficiency of superheaters and feed-water heaters, which will require numerous test measurements before the best proportions can be arrived at.

RESTRAINING ADVANCES IN RATES.

The proposition to give the Interstate Commerce Commission power to suspend an advance in rates which is complained of, pending investigation of its reasonableness, has been made by President Taft a feature of his railway policy. There are strong objections to this, both legal and economic, some of which we have stated in the past. The enjoining of the *collection* of an advance in rates, pending investigation of its reasonableness, is the function of a court of equity. The power which it is proposed to confer on the commission would be somewhat analogous. It is not inconceivable that it might be held by the courts to be substantially the same. If so, it can hardly be doubted that they would pronounce the act giving it unconstitutional; for that Congress cannot confer on an administrative body like the commission the powers of a court of equity is beyond question.

But in one very important respect the power that it is pro-

posed to give differs from the function exercised by a court. The court, in temporarily restraining a railway from *collecting* an advance in rates, also requires complaining shippers to give bond to pay the higher rate from the date of the advance if it shall finally be held to be reasonable. What it is proposed to give the commission is not merely the power to restrain the *collection* of the advance, pending investigation, but the power to absolutely restrain the advance itself. If, a year afterward the advance should be held reasonable, the road would have been absolutely deprived, during that time, of the difference between the lower unreasonable rate and the higher reasonable one. The effect would be to give the commission a limited, but very important power of initiating rates. When the railway advanced a rate the higher rate fixed by it would be its only legal rates; and if the commission required it, while investigation was pending, to accept a lower rate, obviously this lower rate would be one fixed by the commission. The fixing of this lower rate would be a legislative act. But it is well established by the decisions of the courts that the legislature cannot itself fix a rate, nor empower a commission to fix one, for review of which the carrier cannot appeal to the courts. It follows that the carriers could appeal to a federal court, and, after making a *prima facie* case, get an injunction restraining the commission from enforcing its order until it had shown that the rate it had fixed was not unreasonably low. The order which the commission would issue requiring the roads to accept the rate which they previously had had in effect would be similar to the orders it now issues for reductions in rates, except that they would be issued before final hearing; and the situation that would result from the issuance by a court of an injunction restraining the commission from enforcing such an order would be similar to the situation that now results when a court enjoins the commission from enforcing an order for reductions in rates. To say that a court could not restrain the commission from enforcing such an order is to say that Congress can give the commission the power to fix, *without previous final hearing*, rates which could not be judiciously reviewed, although it is a well-established principle that it cannot constitutionally be given power to fix rates, *even after final hearing*, except subject to judicial review.

It may be answered that the commission would merely be authorized to fix, during the interim, the same rates which the carriers previously had voluntarily fixed; and that it could not be held that the rates they had voluntarily fixed were so unreasonably low that they could not be compelled to continue temporarily to accept them. But, suppose, for example, that conditions should exist which should enable the Great Northern and the Northern Pacific, by making an abnormally low rate from eastern Washington to Duluth, to get, for a short time, despite the competition of the boats around Cape Horn, such a heavy movement of grain exported to Europe as would make the low rate, *because of the large movement*, temporarily profitable. And suppose, after the large volume of grain had been moved, the carriers should seek to raise the rates, because, as applied to the smaller normal volume of grain traffic, it had become entirely unremunerative. The commission could not have compelled the carriers to make the abnormally low rate in the first place, when, owing to the large volume of traffic to be gained by it, it might be relatively remunerative. Could the commission, then, because the carriers had once made the rate, compel them to continue to apply it for any length of time, however short, after the grain traffic had become so small as to make it totally unremunerative?

Whether the proposed addition to the power of the commission should be regarded as positive or negative—as the power positively to fix the rates to be charged during the pendency of litigation or the power negatively to prevent the railways from raising them—the legislation giving it would in principle involve a radical departure from all past federal legislation. Past legislation has recognized the fact that the railway is both a private and a public corporation. It is private in its ownership and management. It is public because the service that it renders is a public service. In recognition of its private character past legislation has left the initiation of all its charges to the discretion of its managers. In recognition of its public character the Interstate Commerce Commission has been given the power to control and correct the abuse of this discretion. The proposed legislation would submerge its private in its public character. If the commission were given authority to restrain every advance in rates, it would exert an important control, and a still more important influence, over the exercise of the traffic manager's discretion in the first instance. We know from past experience what would follow. There would be complaint against almost every advance that the railways attempted; and the practical result would be, however the law might read, that the carriers would be prohibited from making any advance without the commission's consent. And if the traffic managers knew that if they lowered a rate they never could raise it, no matter how unprofitable it proved, without a contest before the commission, they would rapidly cease to make any reductions without a previous contest. Thus, the proposed legislation would as effectually prevent reductions which the shippers might need as advances which the railways might need.

President Taft favors the creation of an Interstate Commerce Court, to which all appeals from orders of the commission for reductions in rates should be made. Why should not Congress give this court the same power to restrain advances in rates in any part of the country that is now exercised by the federal courts in their respective jurisdictions, instead of conferring on the commission a power which savors of both the judicial and the legislative functions? This would be much more equitable, much more consistent both with past federal regulation of railways and with other features of the President's policy and much more expedient. One complaint about the issuance by courts of injunctions restraining advances in rates under the present law is that often no court can take cognizance of all the interests affected. A court whose jurisdiction was coextensive with the country could do so. Instead of the carriers being absolutely prohibited from *making* an advance, the court would simply restrain them from *collecting* it, as courts of equity do now, pending investigation of its reasonableness, and at the same time would require all shippers to pay in escrow the difference between the lower and higher rates or to give bond to pay the difference in case the higher rate ultimately was held reasonable. If the advance was found unreasonable the shippers would not have to pay it. If it was held reasonable the railways would not be compelled, either to submit for a considerable time to deprivation of their legal rights or to appeal to the courts to restrain the commission from restraining them from taking what was their due. The right of the railways to initiate all rates would be recognized then just as it is now, and the tendency to prevent needed adjustments of rates to changing conditions probably would not be much increased.

COMPARATIVE OUTPUT IN FINISHING CAR WHEELS AND AXLES.

Car wheels and axles are the most numerous of all the heavy pieces which pass through the railway machine shop. There are few railways on which the number is so small as not to justify the most improved machine tools for finishing them, and by concentrating the work it ought to be possible to keep such machines constantly employed. The use of old tools on this kind of work can scarcely be justified by any road having an ordinary equipment of freight cars, but it is undoubtedly true that many of the lines having thousands of freight cars are using antiquated tools on this class of work, where there is the greatest opportunity to reduce cost by the use of more efficient tools.

In order to get some indication of the every day practice

in turning car axles, boring wheels and turning steel-tired wheels or solid steel wheels, we sent out a circular to a large number of car shops, asking for the number finished in a day of ten hours under ordinary conditions, and some of the replies are given in the tables below. While the names of the machine tool builders are given, there is little to indicate the date when the machines were built, and it is safe to conclude that, excepting those which are motor driven, the tools are old and the output is not nearly equal to that obtained from modern tools.

TURNING IRON AXLES.

Size of journal.	Tool maker.	Number turned in 10 hours.
4¼ in. x 8 in.	Niles-Bement-Pond, double	6
4¼ " x 8 "	Niles-Bement-Pond, double	12
5 " x 9 "	Sellers, single, 1882	9
5 " x 9 "	Putnam, 10-in. double head	10
5 " x 9 "	Niles-Bement-Pond, double	13
5 " x 9 "	Niles-Bement-Pond, double	20
5½ " x 10 "	Putnam No. 3, double	10
5½ " x 10 "	Niles-Bement-Pond, double	12

In turning iron axles, 4¼ in. x 8 in. journals, one road reports only 6 per day, while another with the same make of tool reports 12 per day. On 5 in. x 9 in. axles the number varies from 9 to 20, the latter being an output which ought easily to be obtained from any good modern tool. For the 5½ in. x 10 in. axles the reports show 10 to 12 per day, but this again is only about one-half the number which should be turned out in a well-equipped shop.

TURNING STEEL AXLES.

Size of journal.	Tool maker.	Number turned in 10 hours.
4¼ in. x 8 in.	Niles-Bement-Pond, double	6
4¼ " x 8 "	Niles-Bement-Pond, double	14
4¼ " x 8 "	Bridgeport	18
5 " x 9 "	Niles-Bement-Pond, double	4
5 " x 9 "	Putnam, double	10
5 " x 9 "	Niles-Bement-Pond, double, motor-driven	13
5 " x 9 "	Niles-Bement-Pond, double	20
5½ " x 10 "	Sellers, single-head, 1882	8
5½ " x 10 "	Niles-Bement-Pond, double	9
5½ " x 10 "	Niles-Bement-Pond, double	10
5½ " x 10 "	Putnam No. 3, double	10

In turning steel axles the weakness of the old tools (due in the first instance to the small amount of power transmitted by the belt) is apparent, one road reporting as low as 4, another 6, while another with a lathe made in 1882 reports 8. The highest number of 4¼ in. x 8 in. steel axles is 18; 5 in. x 9 in., 20; and 5½ in. x 10 in., 10 axles. A fair average output per 10 hours from a modern lathe would be 20 steel axles 5½ in. x 10 in.; 25 steel axles 5 in. x 9 in.; and 30 axles 4¼ in. x 8 in.

Double axle lathes for this kind of work are now in general use in all well equipped shops, and the power required by them is so large and the advantages in changing speed sufficient to justify motor driven tools wherever there is electric current available, as they insure plenty of power for heavy cuts and ready speed adjustments. The feed should not be less than ¼ in. for roughing and the cutting speed 50 ft. per minute. There should be provided also convenient cranes or hoists for placing and removing axles, tools with proper shapes on the cutting edges and fixed points on the machine for setting the tools for proper caliper. Much time can be saved also by providing convenient gages for the length of finished parts which are of different diameters.

BORING 33-IN. CAST IRON WHEELS.

Tool maker.	Number bored in 10 hours.
Niles-Bement-Pond	30
" " "	30
" " "	30
" " "	35
" " "	40
Putnam	40
Putnam, motor-driven	50
Niles-Bement-Pond	54
Bement, 1869	60
Niles-Bement-Pond	70
Putnam, motor-driven	70
Niles-Bement-Pond	80
Niles-Bement-Pond	80
Putnam No. 2, 1907	90
Niles-Bement-Pond	100

In boring cast iron wheels there is naturally some difference in the time required on acount of the variation in the relative size of the core and the finished bore, as well as in the hardness of the metal and the roughness of the scale left by the core. The number bored per day of ten hours as reported varies from 30 to 100, showing a wide margin of efficiency, due in part to the use of old tools which are weak and poorly belted and largely to the slowness of the operator and poor management of shop labor in general. The general average on most railways is probably 60 to 70 wheels bored per day, while 100 is reported for one shop and we believe this could easily be obtained for normal output, as we have a record which shows that under most favorable conditions with a modern wheel borer, driven by a 20 h. p. electric motor and forced to maximum output, as many as 150 cast wheels can be bored per day.

BORING 36-IN. SOLID STEEL WHEELS.

Tool maker.	Number bored in 10 hours.
Niles-Bement-Pond	10
Putnam No. 2, 1907	25
Putnam motor-driven	30
Niles-Bement-Pond	40
Niles-Bement-Pond	45

The boring of solid steel wheels has not been performed in sufficient quantities at most car shops to establish any record which can be taken for a fair average. The few reports received indicate the same variation in the output at the different shops, from 10 as a minimum to 45 as a maximum, with a probable average of 25, or about one-half the number which should be bored under proper conditions.

TURNING STEEL-TIRED WHEELS.

Size of diameter.	Name of machine.	Number of pairs turned in 10 hrs.
36 in.	Niles-Bement-Pond	4
36 "	" " "	5
36 "	" " " old style, small	5
42 "	" " "	5
36 "	" " "	5
36 "	" " "	6
36 "	" " "	6
36 "	" " " motor-driven	8
40 "	" " " 1905 motor-driven	8½

The record for turning wheels applies to steel tired wheels, as few of the solid steel wheels have been in service a sufficient time to require turning. It shows an output as low as 4 pairs of tires per day, and a number of roads report only 5 pairs per day, while the best is 8 and 8½ pairs. Even the best performance here is far below that which it is possible to attain for an every day performance. We have other records which show that a modern steel tired wheel lathe driven by a 30 h. p. motor can turn 21 pairs of 33 in. wheels in 10 hours, and under piece work or premium system should turn 20 pairs as a regular daily performance.

There is such a large amount of this work to be done that the demand for high power lathes for tire turning has produced several which can more than double the best performance shown in our table, and at least one lathe which showed on tests a record equal to three times the best output reported in reply to our circular. This new lathe uses a cut and feed ⅜ in. each, at a speed of 17 ft. per minute, and is driven by a 34 h. p. electric motor. It has reduced the diameter of a pair of 36 in. tires ¾ in. and finished tread and flange in 20 minutes, or at the rate of 3 pairs per hour and 30 pairs in 10 hours. While it is not supposed that this rate would be sustained as a regular performance, yet it is fair to expect that the machine could be put on a normal rating of 25 pairs of steel tired wheels finished per day.

The use of solid steel wheels in freight cars of highest capacity is growing rapidly, and there soon will be in service such large numbers of these wheels that their maintenance will require additional tool equipment in most car shops. These wheels will develop sharp flanges and irregular treads under heavy loads in freight service more rapidly than the hard chilled cast iron wheels, and the amount of turning required will be very large as compared with the steel tired wheels from the comparatively few passenger cars in service on any railway. Under such conditions the slow performance of only 5 or 6 pairs of wheels per day cannot continue, as the

mounted wheel on a 50-ton axle represents an investment of $60, and hundreds of these would be standing awaiting repairs if more efficient methods were not adopted. There will be, therefore, in the near future, a large demand for high power lathes for turning the solid steel freight car wheels and for stronger mills for boring them.

SOUTHERN PACIFIC.

In 1901 E. H. Harriman was chairman of the executive committee of the Southern Pacific, Charles M. Hays was president and Charles H. Tweed was chairman of the board of directors. The following year Mr. Harriman was elected president as well as chairman of the executive committee, and the position of chairman of the board of directors was abolished. In his report for the fiscal year ended June 30, 1901, Mr. Tweed forecast quite accurately the policy which Mr. Harriman from then on followed, one of the direct results of which was the enormous economies in cost of operation in the fiscal year ended June 30, 1909. Mr. Tweed said: "Although earnings for the year just closed have shown such a gratifying increase, it should be borne in mind that a considerable part thereof should continue to be devoted toward the physical improvement of the property and additions thereto."

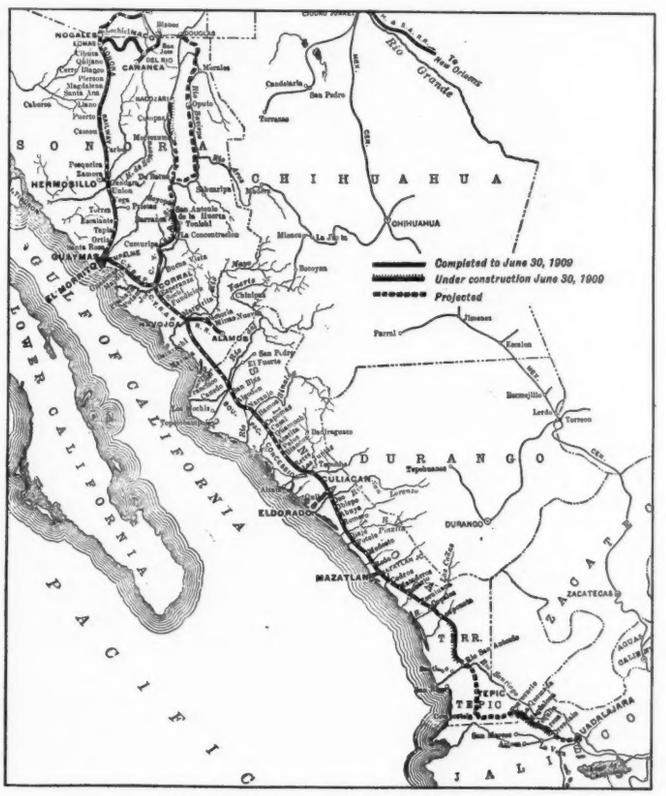
At that time 36.46 per cent. of rails in main and second track were 60 and 61-lb. sections and 20.46 per cent. were 50-lb. rails. In 1909 but 38.70 per cent. were less than 75-lb. and 29.48 per cent. were 80-lb. rails. This showing is simply an index of what has been going on in the betterment of lines operated by the Southern Pacific Company and proprietary companies. A comparison of the capacity of rolling stock and the tractive power of locomotives would show much the same improvement. The improvement in roadbed has been paid for largely out of income. In the past eight years the company has spent on an average $1,496 per mile of first and second main track and branches for maintenance of way. An analysis of charges for maintenance of equipment tells much the same story of betterment of property by expenditures from income.

In our review of the annual report for 1908 considerable stress was laid on the expansion of the system through the construction of new lines, especially in Mexico. This work has progressed rapidly in the past fiscal year, and the company incorporated June 24, 1909, under the name of the Southern Pacific Railroad Company of Mexico, with a capital stock of $75,000,000 (all held by the Espee) took over all the rights, properties and franchises of the Cananea, Yaqui River & Pacific, and also the several concessions granted to the Southern Pacific Company. Under these concessions there was completed during the year 252 miles of line, making a total of 784 miles completed to June 30, 1909, out of a total of 1,503 miles projected. The method of financing this new construction has been to have the Southern Pacific Company advance money to the construction company, which would issue its securities to the Southern Pacific Company, and when the Southern Pacific Company found a good opportunity it sold its own securities to reimburse its treasury for the capital expenditures. The Southern Pacific Company had advanced to the proprietary companies for extensions, additions and betterments $103,300,000 up to June 30, 1908.

During the year the company authorized an issue of $82,000,000 4 per cent. 20-year convertible bonds, which were offered to stockholders at 96. Nearly the entire amount was subscribed for and the company had received up to June 30, 1909, $79,900,000 in payment therefor. Bonds are convertible into common stock at $130 in bonds for $100 par value stock.

The entire outstanding issue of preferred stock amounting to $74,800,000 was called for payment on July 15. The holders were offered the option of taking 4½ per cent. bonds with $20 in cash in exchange at par for their stock, or of converting the preferred into common at par, or of surrendering their stock and receiving $115 cash per $100 share. Up to June 30, $16,061,000 preferred stock had been converted into common, $107,000 had been offered and accepted by the company at $115 and $72,000 had been converted into new 4½ per cent. bonds. Since the common stock of the Southern Pacific was selling in the neighborhood of $130 per share in the latter part of June and early part of July, presumably most of the prefered stock was retired through the issue of new common stock.

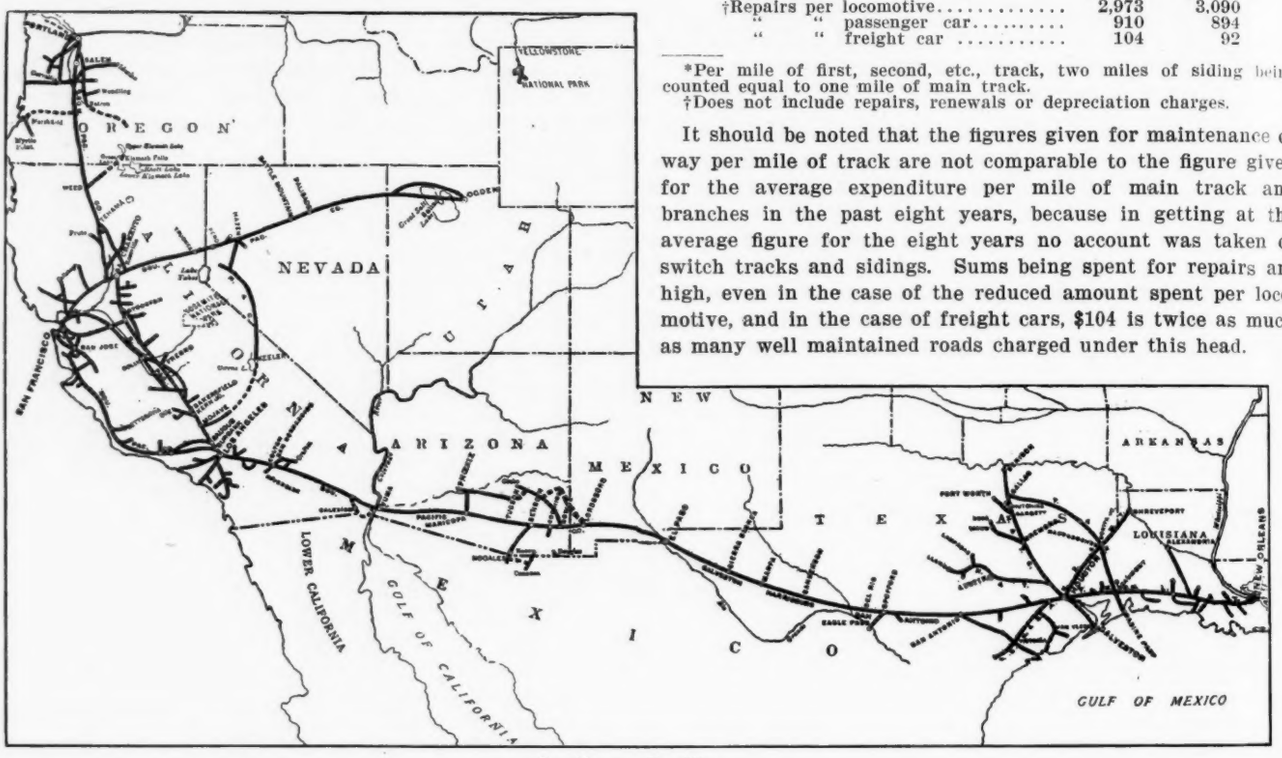
Notwithstanding the great additions made to the system and the great works of improvement carried out during the past eight years, such, for instance, as the building of the Lucin cut-off across Salt Lake, the financing of the company has been thoroughly conservative. It is possible to make a rough estimate of the general course pursued by the management by a comparison of the balance sheet of 1901 and that of 1909. In 1901 total capital liabilities were $244,000,000; in 1909, after the issue of the convertible bonds previously mentioned, they were $392,000,000. This is an increase of $148,000,000. Stocks and bonds owned, including securities deposited under mortgages, were carried as a capital asset valued at $248,000,000 in 1901 and $304,000,000 in 1909. This is an increase in book value of $56,000,000, the entire amount of which, with one or two small exceptions, is an addition to the free assets of the Southern Pacific Company, since the amount of bonds and stock deposited under mortgages and under the Southern Pacific common stock has been increased only slightly.



Lines of the Southern Pacific Railroad of Mexico.

The valuation of the newly acquired securities held as free assets appears to be conservative, since the par value of these unpledged securities was $3,200,000 in 1901 and $200,800,000 in 1909. Beside the $56,000,000 increase in capital assets, deferred assets have increased from $4,600,000 in 1901 to $124,300,000 in 1909. The advances for new construction and for rolling stock alone during the eight years has been approximately $94,000,000, and real estate and other property carried as a deferred asset has increased in value from $2,400,000 to $16,600,000.

The substance of all this is that while Mr. Harriman was the active head of the Southern Pacific, the company undertook an enormous amount of work, both on new lines and on improvement of existing ones, without correspondingly increasing its fixed charges or dividend requirements, and, moreover, the issue of the 4 per cent. convertible bonds has apparently put the company in a position where it will not have to do any new financing for some little time to come. On June 30, 1909, there were current assets of $60,000,000, as compared with $25,900,000 current assets in 1908. Of these sums, $31,800,000 was cash in 1909 and $5,800,000 in 1908. Current liabilities, in contrast to this showing of assets, amounted to $23,100,000 last year as against $74,200,000 the year before, the company having paid off among other debts the entire amount of loans and notes payable totaling $52,500,000.



Southern Pacific.

The lines operated by the Southern Pacific Company and Proprietary Companies are shown on this map, but the lines of the Southern Pacific Railroad of Mexico are not shown.

The economies in operating expenses last year were really so extraordinary that it is necessary to carefully study what has been done in the past to avoid making the mistake of thinking that these economies were the result of temporarily *holding down* maintenance and other expenses in order to make a good showing in net earnings. Gross operating revenue was $111,000,000 in 1909 and $114,000,000 in 1908. Operating expenses were $67,000,000 in 1909 and $76,000,000 in 1908. This left, after clearing outside operations and deducting taxes, operating income of $40,900,000 last year, as against $34,700,000 the year before.

Under the head of transportation expenses is the most obvious place to look for economies that are the result of greater efficiency and a better "working plant." In 1909 transportation expenses amounted to $32,800,000. This compares with $37,800,000 spent in 1908. The saving of $5,000,000 or over 13 per cent., made in the cost of conducting transportation came in part from a reduction in the gross business. There were 6,056,000,000 tons of freight carried one mile last year, as against 6,486,000,000 the year before, and 1,367,000,000 passengers carried one mile last year and 1,452,000,000 the year before. In greater part the saving came from economies made possible by the lower cost for fuel and the decrease of locomotive mileage due to better train loading. The cost of fuel for locomotives was less by 14.67 per cent. last year than in the previous year, and the cost of station and terminal service was less by 12 per cent. The decrease of 17.46 per cent. in the expenses incident to injuries, loss, damage, etc., is a tribute to the efforts being made to raise the standard of the operating force.

Maintenance of way and structures as a whole cost $14,500,000, or 15 per cent. less than in 1908, and maintenance of equipment cost $14,400,000, or 7 per cent. less than in 1908. The following table compares the unit costs of maintenance:

	1909.	1908.
*Maintenance of way	$1,259	$1,342
†Repairs per locomotive	2,973	3,090
" " passenger car	910	894
" " freight car	104	92

*Per mile of first, second, etc., track, two miles of siding being counted equal to one mile of main track.
†Does not include repairs, renewals or depreciation charges.

It should be noted that the figures given for maintenance of way per mile of track are not comparable to the figure given for the average expenditure per mile of main track and branches in the past eight years, because in getting at the average figure for the eight years no account was taken of switch tracks and sidings. Sums being spent for repairs are high, even in the case of the reduced amount spent per locomotive, and in the case of freight cars, $104 is twice as much as many well maintained roads charged under this head.

The development of train loading on the Southern Pacific in the past few years has been remarkable, because even in 1901 the train load was exceedingly heavy for a road with comparatively little low-grade tonnage, being 305 tons. Last year the train load was 461 tons. This is an increase over the 1908 train load of 57 tons, or 14 per cent. The average distance each ton of freight, including company freight, was carried was 257 miles in 1909 and 271 miles in 1908, the average receipts per ton per mile being 1.154 cents last year and 1.097 cents the year before.

The average revenue per passenger per mile was 2.185 cents in 1909 and 2.174 cents in 1908, and the average distance each passenger was carried was 73 miles last year and 76 miles the year before. The Southern Pacific has not only high class traffic, but also in parts of the country exclusive territory as well.

Car mileage figures speak eloquently of better operation. Loaded car miles—revenue service—totaled 351,000,000, or 4 per cent. less than the year before, while empty car miles was 136,000,000, over 13 per cent. less than the year before. Caboose car mileage decreased by 20 per cent. The ratio of loaded freight car mileage to the total was 72 per cent. last year and 70 per cent. the year before, while the ratio of empty car mileage to the total was 28 per cent. last year and 30 per cent. the year before.

The comparatively high receipts per ton per mile are explained in part by the very small proportion of total traffic that is furnished by coal. In 1909 but 0.01 per cent. of the total revenue tonnage was furnished by anthracite coal and 2.83 per cent. by bituminous coal. A comparison between two years of the percentage of tonnage furnished by various commodities, while it may throw considerable light on industrial and agricultural conditions in the region traversed by a road, is often misleading when taken as an indication of the general trend of development of traffic—but this is not so when a comparison is made over a number of years. On the Southern Pacific the development of the lumber industry and consequent larger shipments of products of forests is one of the most marked changes in the character of traffic carried. In 1903, for instance, a little over 17 per cent. of the total revenue tonnage was from products of forests, while in 1909 over 20 per cent. was from products of forests. These figures show the relatively greater increase in lumber shipments. The actual increase in tonnage carried was from 2,990,000 tons in 1903 to 4,580,000 tons in 1909. Products of agriculture, on the other hand, furnished 26 per cent. of the total tonnage in 1903 and but 22 per cent. in 1909, the number of tons carried being 4,500,000 in 1903 and 4,900,000 in 1909. The tonnage of products of animals, which furnished a little over 4 per cent. of the total in 1909, has increased since 1903 in just about the same proportion as has the total tonnage, and the products of manufactures, which furnished 16 per cent. of total tonnage in 1909, also shows an increase in shipments just about proportionate to that of all products.

Stability of earning power is the characteristic of such a road as the Southern Pacific, because in the first place the territory covered is so extensive that local depressions and booms offset each other, and because the traffic, as shown by the comparisons that we have just made, is so diversified that a bad year in any one line of industry affects only slightly the grand total of shipments.

The following table compares the results of operation in 1909 and 1908:

	1909.	1908.
Average mileage operated....	9,626	9,506
Freight revenue	$69,878,880	$71,073,568
Passenger revenue	34,345,339	35,800,592
Gross operating revenue.....	110,846,404	113,545,567
Maintenance of way.....	14,533,135	17,083,236
Maintenance of equipment.	14,379,762	15,539,095
Traffic	2,069,940	2,160,430
Transportation	32,846,193	37,804,201
Total operating expenses....	67,191,875	76,005,494
Taxes	3,788,242	3,950,140
*Operating income	40,937,534	34,663,729
Gross corporate income.....	46,209,883	38,657,477
Net corporate income	26,8[illegible]9,402	19,877,741
Appropriated for surveys, etc.	64,461	19,027
Dividends	17,436,974	17,112,700
Surplus	9,477,966	2,746,014†

*After clearing outside operations, which are not included either in the revenue or in the expenses shown in this table.
†This figure is slightly less than that given in last year's annual report, apparently because of minor readjustments in accounts.

NEW BOOKS.

First Annual Report of the Board of Supervising Engineers of Chicago Traction. Published by the Board, Chicago, Ill. 462 pages; 5¾ in. by 8¾ in.; cloth.

The Board of Supervising Engineers is made up of Bion J. Arnold, chairman; George Weston, representing the city of Chicago; Henry B. Fleming, representing the Chicago City Railway Company; John L. Murphy, representing the Chicago Railways Company, and F. K. Parke, secretary and auditor. These gentlemen have prepared an elaborate report, designated as first annual report, which presents very completely the Chicago traction situation, past and present.

Railway Association of Special Agents. Proceedings of the Thirteenth Annual Convention. Baltimore, Md.: W. C. Pannell, Secretary.

This association is made up of "railway special agents and police of the United States and Canada," and the discussions at their annual meeting, held in Peoria last June, fill this pamphlet of 160 pages. Among the topics were the railway tramp; seals and fastenings; the discharged prisoner; loss of freight under seals; triple valve thieves, criminal laws; anti-sweeping ordinance (a discussion of losses of grain due to stealing by roving persons allowed to sweep out cars); bureau for the identification of criminals; damaged freight; concealed losses. Not the least interesting feature of the book is the large number of portraits of officers of the association and other prominent members. The president of the association is H. H. Germain (A., T. & S. F.), Topeka, Kan.

Hendricks' Commercial Register. Eighteenth Annual Edition. Samuel E. Hendricks Co., New York. 1308 pages; 7½ in. x 10½ in. Cloth. Price, $10.00.

This is an index of industries of the United States, with especial reference to architectural, mechanical, engineering, contracting, electrical, railway, iron, steel, hardware, mining, mill, exporting and allied businesses. It has some 350,000 names and addresses, under about 33,000 classifications. The kinds of business in which the firms are engaged are arranged alphabetically, the names under each business being grouped by states and cities. Trade names of products are given after the name of the company. The publication is one of the most useful of its kind. It would be more convenient, for many uses, if it had also a full list of all the firms mentioned classified alphabetically, without regard to product or geographical location.

Lighting Engineers' Handbook. Compiled by L. R. Pomeroy. Published by the Safety Car Heating & Lighting Co., New York. 231 pages; 4¼ in. x 7 in.; illustrated. Leather. Price, $1.00.

This handbook is based on extracts from the compiler's notebook and was prepared for the particular use of car lighting engineers. It begins with some general data such as should be included in all pocketbooks for the use of mechanical engineers. The next division, electricity, gives wiring formulæ, various tabular information, and characteristics of electric motors and generators. Under lighting is given data on circuits, characteristics of various materials used for globes, candle power required for various conditions, current consumption of various lamps, etc. Results of tests showing relative efficiency of different kinds of gaslights are here given, together with a large amount of detailed analytical information. The Safety Car Heating & Lighting Company's electric car lighting system is then described, together with figures on Pintsch gas outfits. The book is not confined entirely to car lighting. The portion described above takes up only about two-thirds of it. The remainder consists of thermodynamic tables and miscellaneous steam engine data, description of the thermo-jet system of car heating, figures on steam and electric locomotives, pipes and tubes and hydraulics.

Letters to the Editor.

FIREBOX FAILURES.

Minneapolis, Minn., Nov. 25, 1909.

TO THE EDITOR OF THE RAILROAD AGE GAZETTE:

I was very much interested in the report of Mr. Hughes' (mechanical engineer to the Lancashire & Yorkshire Railway, England) experience with the locomotive boiler. I have for some years been studying the cause of a large number of failures of locomotive fireboxes, and after careful investigation I have come to a similar conclusion as Mr. Hughes, having found that the majority of firebox failures are due to the rigid construction of the firebox and tube plates, these parts not allowing sufficient freedom for expansion and contraction between the heated surfaces and the outer shell of the boiler, which, not being subjected to any heat other than that obtained from the water, sets up severe strains which prove so destructive to the life of the boiler. One has but

to imagine the enormous difference of temperature between the inside of a firebox or flue tube and the temperature of the outside shell to realize the amount of stresses the tube plates are subject to. As the demand for steam becomes greater and the boiler is forced more, the liberation of steam from the underside of the closely set flue tubes becomes more difficult, increasing the resistance in transmission of the heat to the water, and causing the expansion between the flue tubes to be considerable, with the result that the tubes leak at their joints, or strains are set up sufficient to burst out the back tube plate, and very often the tube plates themselves are cracked between the holes or on the top flange of tube plate, so as to allow the tubes to expand more freely. The difference of expansion is still further increased by the deposit of scale on the external surfaces of the tubes, scale being a very bad conductor of heat.

Does it not seem reasonable that if we can have a flexible tube plate at both ends of the boiler a lot of these troubles will disappear? The same argument regarding the tubes applies equally well to the firebox, only that this part of the boiler, which is subjected to much higher temperatures, and is held by a large number of rigid stays to the outer shell, suffers even more than does the tube plates. The firebox is also subject to great variations of temperature, sometimes on account of excessive cold air being admitted during firing, and at other times the fires will develop holes, particularly on the large modern boilers, with large grate areas that cannot be kept properly covered with coal. This cold air, impinging on the sides of the firebox, sets up severe local strains that cannot be overcome, unless the material of the firebox is made in such a form as to yield locally to these conditions; and I think that the Wood form of firebox and tube plates overcomes these troubles in a perfectly mecnanical and practical way.

When the corrugated firebox was being introduced for marine service all kinds of objections were raised regarding the scale lodging in the corrugations, but after a number of years' experience under all conditions of marine service it has been found not to scale more than the ordinary straight flue, and the corrugated furnace is now universally used in all first-class marine boilers. Since the adoption of corrugated flues for marine boilers nearly all the troubles of leaky tubes, etc., have disappeared.

The same cylindrical type of furnace has been tried in the Vanderbilt style of locomotive boiler. These, however, did not do well, the failures being chiefly due to lack of grate area and to the great thickness of the metal necessary to withstand the compression strains under high pressures. Another disadvantage of the Vanderbilt type of boiler is the very great difference of temperature that the furnace is subjected to above the fire bars. The cold air entering below the bars sets up severe strains; much more than in any other type of boiler. The writer has been on engines with the corrugated cylindrical firebox, and it was found almost impossible to get any circulation *around the firebox* in this type. Before the engine could leave the roundhouse it has had to be drawn up and down the shed by means of another engine so as to mix up the water in the lower part of the furnace.

In Mr. Wood's type of firebox he has overcome these disadvantages by keeping the regular rectangular form of firebox with the fire at the lowest point, and corrugating the sides and roof in one piece, and this, in my opinion, is an ideal form of locomotive firebox. One of the great advantages is the increased heating surface of the firebox. This heating surface, exposed to the direct radiant heat of the fuel, has been proved to be from three to four times more valuable for steam raising than the tubular portions of the boiler, and certainly will make a great deal more steam and be more economical than an ordinary firebox of larger dimensions with the same heating surface.

DAVID CROWTHER,
Mechanical Engineer.

Contributed Papers.

ALTOONA FOUNDRIES, PENNSYLVANIA RAILROAD.

The general foundries of the Pennsylvania Railroad are located at South Altoona, on the Holidaysburg branch, about two miles from Altoona. They were given their present location because of the congested condition of the shops at Altoona, where it was impossible to increase the capacity of the old foundries, and there was great demand for the space they occupied for the enlargement of the machine shops. The foundries for soft iron and for wheels, therefore, were removed to South Altoona, where ample room in the open country could be obtained. The site selected is, as stated, on the Holidaysburg branch, which connects Altoona with the low-grade freight line over the Alleghenies, between Holidaysburg and Gallitzin. The shops were laid out and designed by the motive power department, and include the two departments of soft gray iron and wheel work, each of which is housed by itself and the two quite separate and distinct.

The plant occupies a plot of ground of something more than seventy acres, lying between the railway tracks and Sixth avenue, with a total length of about 3,700 ft. and a width of about 839 ft.

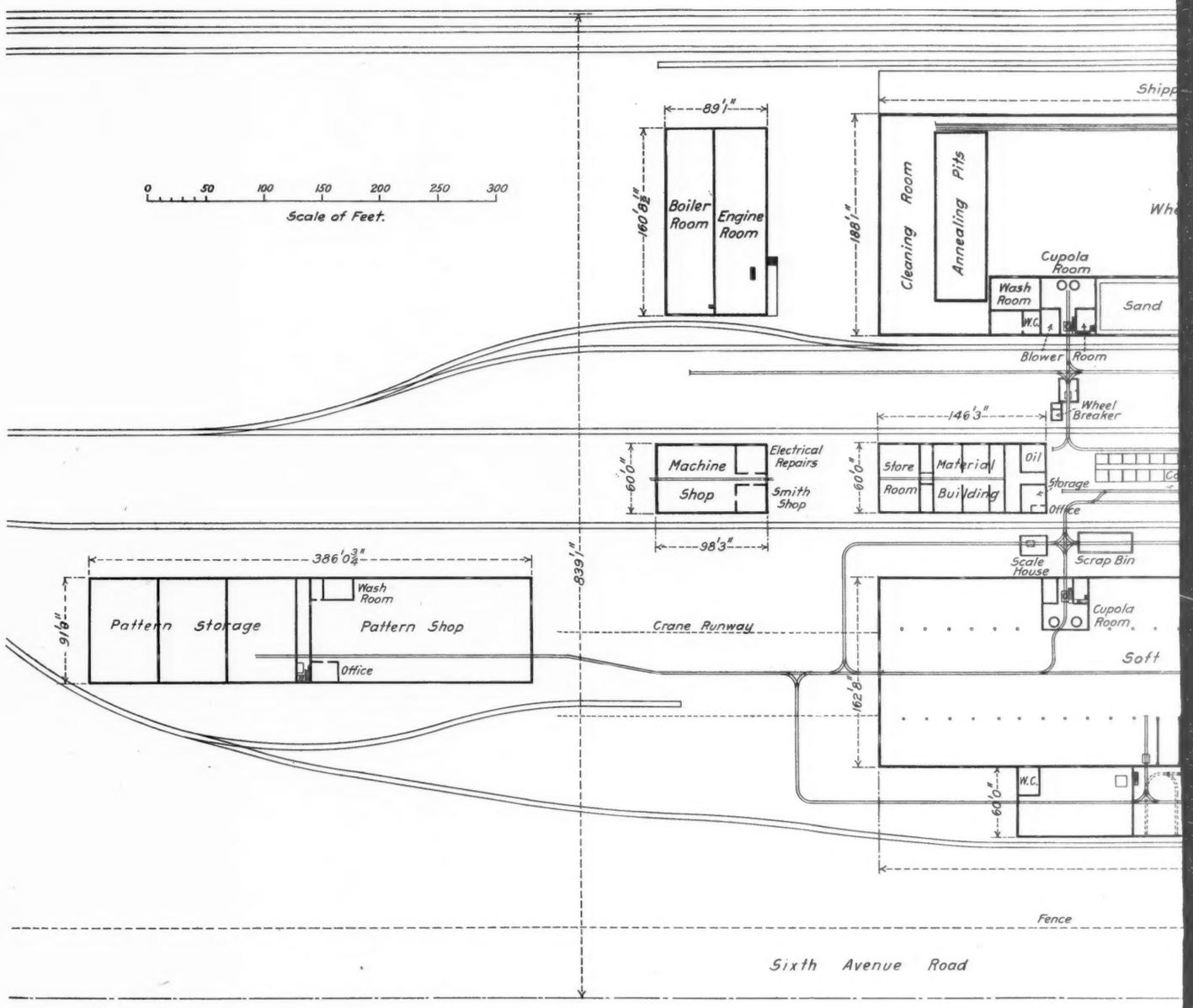
The two principal buildings on the premises are the wheel and soft iron foundries, which are located in line with each other, but separated by a yard 206 ft. 1½ in. wide. The grouping and general arrangement of the plant is shown in the accompanying engraving. The yard tracks that are located back of the office building are brought together and are finally led into the main line about 1,200 ft. north of the South Altoona station.

The office building, a two-story brick structure, 40 ft. by 60 ft., is placed opposite the main entrance gate to the grounds and contains the executive offices of the plant, together with the recently installed chemical laboratory, whose work will be discussed later in connection with the manufacture of wheels. The two foundry buildings have steel frames with brick walls. The soft iron foundry measures 563 ft. 10 in. by 162 ft. 8 in., and the wheel foundry 602 ft. by 188 ft. 1 in.

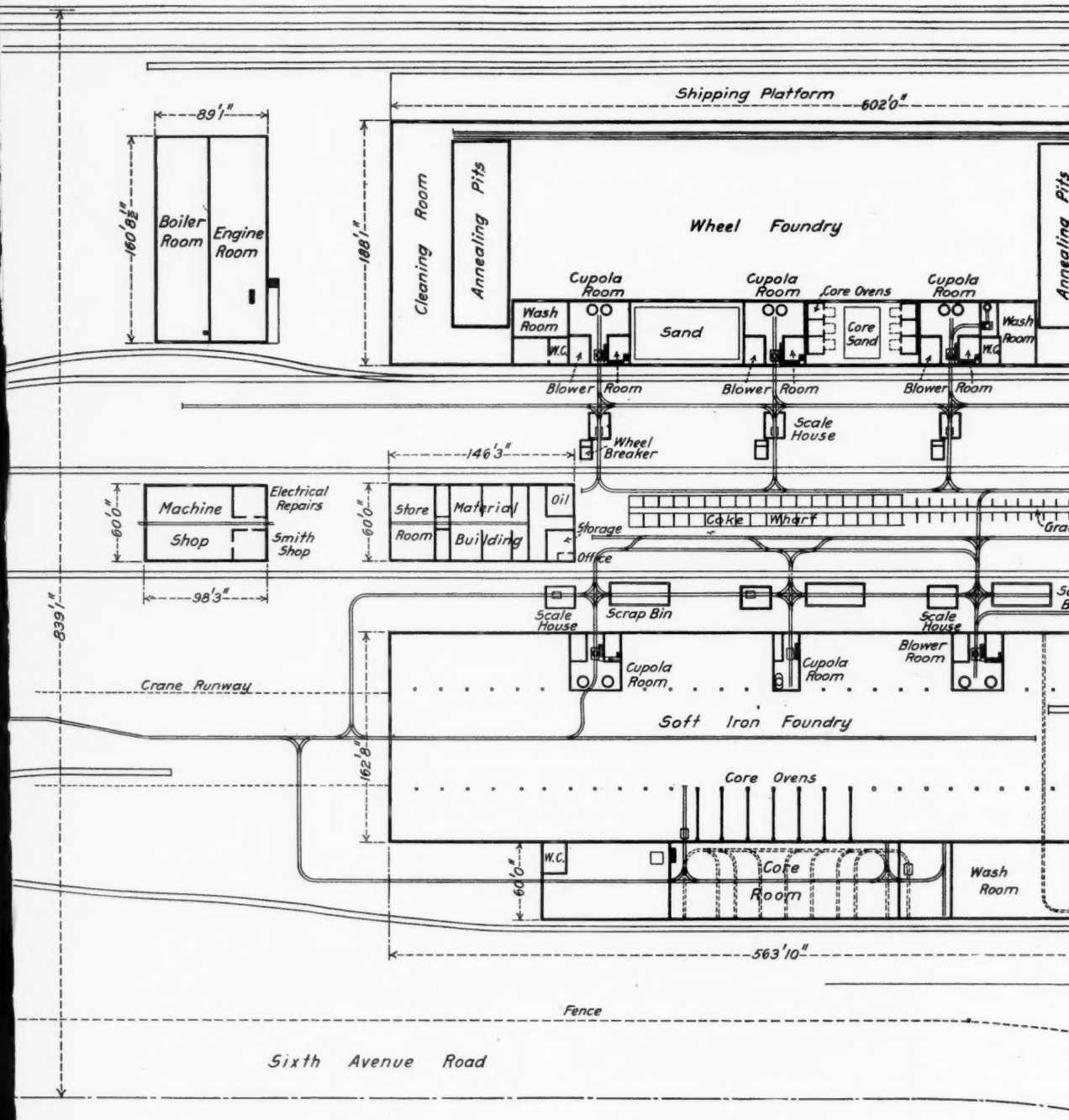
South of the wheel foundry is the power plant, housed in a brick building 89 ft. 1 in. by 160 ft. 8½ in.; and east of this, with a space of 108 ft. 3 in. between, is the machine shop, a one-story brick building, 60 ft. by 98 ft. 3 in.

Finally, south of the soft iron foundry is the pattern shop, also of brick, and measuring 386 ft. ¾ in. by 91 ft.

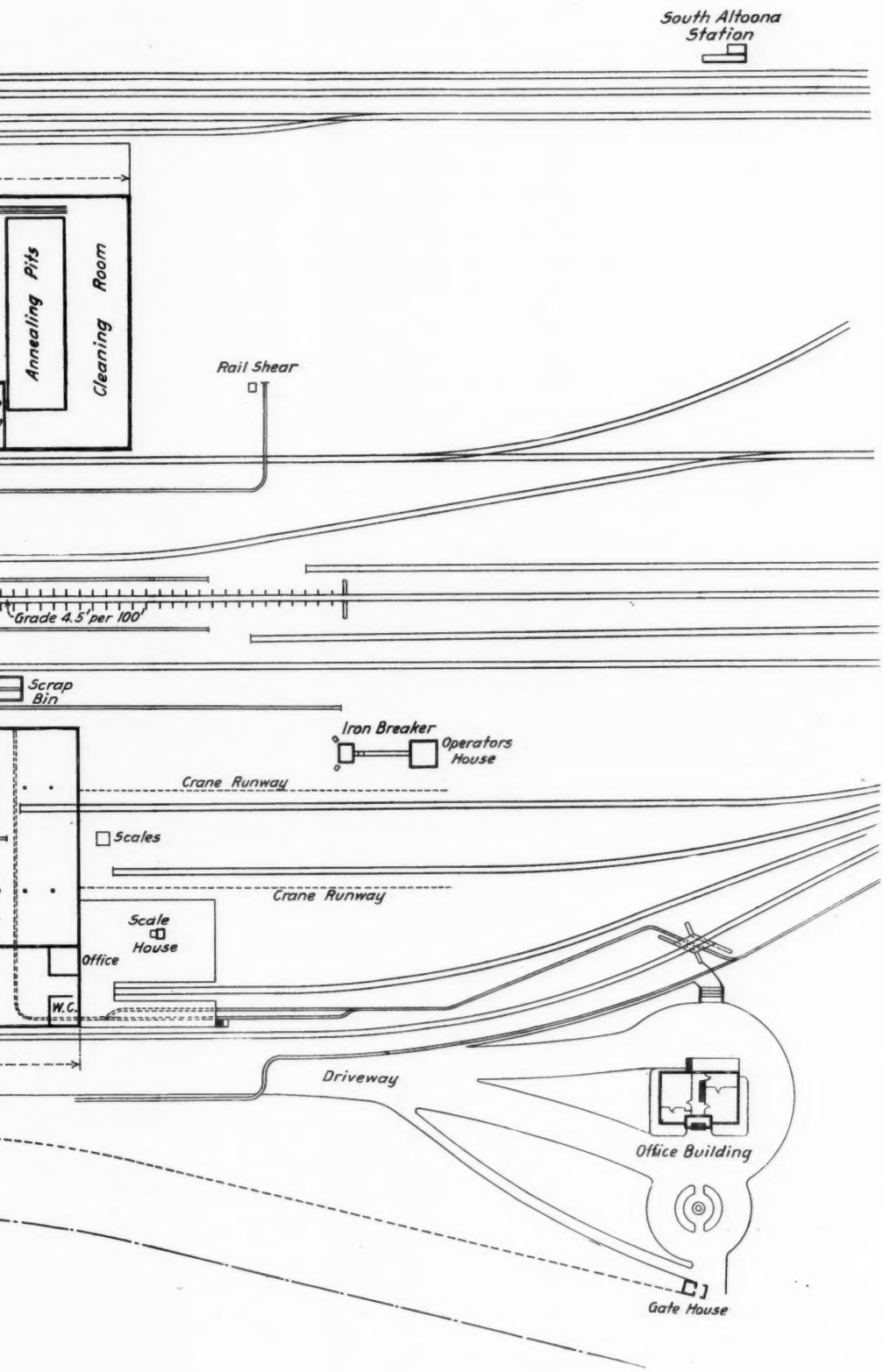
These foundries are intended as the main supply of castings for the whole system east of Pittsburgh, and as such are interesting not only from their size, but for the arrangement and methods employed. The gray iron foundry is built with a main central span, with two side bays, with the cupolas set facing the central span, of which the width is 70 ft. from center to center of columns. The side bays are each 45 ft. wide from the inside of the walls to the center of the roof columns. Along the east side of the building there is an extension 60 ft. wide and 440 ft. long, in which are located the office, toilet, wash and core rooms. There are three cupolas, each with a shell 8 ft. in diameter and lined to 7 ft. The central portion of the building is served by two 12½-ton traveling cranes, one 25-ton traveling crane and 10 movable 5-ton jib cranes. All of the travelers are on the same runway just beneath the roof trusses, which extend out through the ends of the building for 275 ft. in each direction. On the north end they serve for loading and shipping heavy castings and at the south the space devoted to flask storage. The openings through the walls are closed by rolling doors 12 ft. high and made of sheet iron, with an angle iron framing, and hinged at the top edges so that they may be swung up



FOUNDRIES OF THE PENNSYLVANIA



FOUNDRIES OF THE PENNSYLVANIA RAILROAD AT ALTOONA.


South Altoona Station
Annealing Pits
Cleaning Room
Rail Shear
Grade 4.5' per 100'
Scrap Bin
Iron Breaker
Operators House
Crane Runway
Scales
Crane Runway
Scale House
Office
W.C.
Driveway
Office Building
Gate House

wards and inwards by an electric motor. Beneath and in the center is a gap opening in the doors, through which large castings may be passed.

The jib cranes, as will be seen by reference to the cross section of building, are carried by a footing set on the same foundation as the roof columns, and by brackets riveted to the latter at a height of about 22 ft. above the floor. These brackets are located at each column along the two sides, except at the cupolas, so that a crane can be placed at any point, where they can reach to within three ft. of the center. These cranes are provided with a lifting eye (A) located directly above the center of gravity, so that they can be picked up by the overhead traveler and carried from place to place as they are needed. As a matter of fact, however, they are now seldom shifted. After a few preliminary adjustments by which they were located in positions most convenient for the prosecution of the work, it was found that they were practically located permanently.

The side bays are served by a five-ton electric traveling crane operated from the floor, as is indicated.

It is, of course, in the center of the building that the heavy work, such as cylinders and the like, is executed. For this work no loam molding is done, but there is a good deal of dry sand work. For this purpose the cores are made of

West Front.

50 per cent. of molding sand and 50 per cent. of sharp sand, with some approved core compound as a binder. For light cores sharp sand and core oil is used. The use of flour, with the old mixtures of sour beer or molasses, has been quite abandoned.

In some parts of the foundry where dry sand cores were once considered a necessity the work is now done entirely in green sand, with a great reduction of expense. This is the case with the work on oil boxes, which is now done entirely in green sand.

The core room is in the annex on the east side of the building, and adjacent to the core ovens. The furnaces for the ovens are below the floor level, and have hot air flues, extending up through the side wall of the oven at the center, while the discharge is near the floor. The cores are carried on cars that are run in and out of the ovens on tracks. Below the core room, which has a cement floor, are the storage bins for sand, which are filled from hoppers below the supply tracks. The sand is taken from the bins on narrow-gage cars that are raised to the foundry floor level on hydraulic elevators and run to the point of use.

In the case of the molding sand, it is first elevated into a hopper, from which it is dropped to the floor and then shoveled into a hopper, where it is elevated and dropped to the mixer, from which it is again elevated to a hopper from which it is again dropped into the cars that carry it to the molding floors.

In the south end of the west bay of the bulding there are 13 molding machines, with the attendant machinery for conveying, handling and tempering the sand. After removal from the machines, which are ranged along the west wall, the molds are set over gratings where they are poured. As the castings are shaken out the sand falls through the gratings to a conveyor, where it is brought back and elevated to a hopper, whence it falls to a mixing and tempering machine, from which it falls into an elevator again, by which it is raised and conveyed over the molding machines to a carrier from which it flows through down spouts to the molds as required.

At the north end of the building there is a cleaning floor. This floor is provided with 12 rattlers for light castings, and they are attached to exhaust fans, by which the dust is removed, and taken to dust collectors, so that there is none of the dust flying about that is the usual accompaniment of this part of the work.

In the pouring of the metal a constant supervision is maintained at the cupola as to its temperature and quality. In taking it to the pouring floors the overhead travelers, as well as truck ladles, are used. In the case of the latter, the ladles are carried on springs, and the weight is counterbalanced in the handle.

For serving the cupolas and raising the metal to the charging floor hydraulic elevators are used.

Provision is also made in the building for the physical comfort of the men in the shape of ample toilet, wardrobe and wash rooms. The wash room is fitted with wash basins, with hot and cold water and an ample supply of shower baths, which are, of course, free to the men.

West of the soft iron foundry and between it and the wheel foundry is the yard for the storage of supplies. Immediately back of each set of cupolas there is a scrap bin and scale house in which the charges are weighed. Beyond this in the center of the yard is a coke wharf, with elevated tracks, approached by a trestle grade of 4.5 per cent., and from which the cars are discharged directly into the bins beneath, from which the fuel is taken to either foundry.

At the end of the coke wharf there is a storehouse for miscellaneous supplies; it is of brick and measures 60 ft. by 46 ft. 3 in.

The iron for the two foundries is run in in cars on the track adjacent to the one in which it is to be used, and from them it is unloaded by a locomotive crane with a magnetic lift attachment. This is used for unloading both pig and scrap, and will handle about 1,000 lbs. at each lift. It requires the

attention of two men, and can unload at the rate of about one ton to a minute.

The pattern shop, south of the soft iron foundry, is a brick building 91 ft. by 386 ft. ¾ in., and is divided into two sections, with a 12-ft. hallway between. The southern section is three stories high and is 180 ft. long, and is used exclusively for pattern storage. It is subdivided into three rooms on each floor, which are separated by fireproof walls, having two openings that are fitted with steel fire doors that are closed under normal conditions. Each room is equipped with fire extinguishers, hose lines, and also with automatic sprinklers operated by valves placed outside of building, and, then, in order to avoid the overloading of the floor, in case of flooding, openings are cut in the side walls, through which the water would be emptied to the outside.

The light machinery of the pattern shop is driven by an elevated motor, but all the heavy machinery is driven by separate motors directly connected. It is a model of fine lighting, the large windows reaching nearly to the eaves in both walls, and in the roof there is a monitor running the whole length and fitted with glass sides and a partial glass roof.

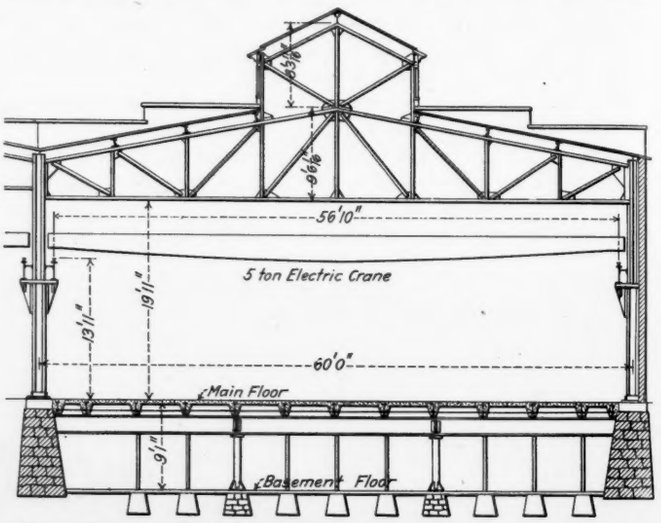
The power house is a brick building 89 ft. 1 in. by 160 ft. 8½ in., located 90 ft. south of the wheel foundry. It is divided longitudinally by a brick wall into two rooms, one for the boilers and the other for the engines, dynamos and pumps.

The engine room is served by a 12½-ton traveling crane, and contains two direct connected cross-compound Corliss engines, driving 300 kilowatt, direct current generators, and two other similar units with 500 kilowatt D. C. generators. These supply current for power and lighting at 250 volts. Compressed air is furnished by two 2-stage cross-compound compressors having a capacity of 750 cu. ft. of free air per minute each. Hydraulic power is generated by two triple expansion hydraulic pumps and accumulators. This is used for operating the elevators, to the charging floors of the cupolas, the hydraulic drop for the wheel breakers and handling the receiving ladles in the wheel foundry. The piping from the pumps is carried from the power house to and alongside the wheel foundry, with two branches leading to the gray iron foundry and the extension to the pattern shop in a concrete tunnel. The electric wires are also located in the same tunnel.

In the boiler room there are eight water tube boilers of 261 h.p. each. They are fitted with mechanical stokers and the draft is produced by two steel stacks, each 175 ft. high.

Coal and ashes are handled by conveyors. The coal supply is brought alongside the building in drop bottom cars and unloaded into a hopper below the ground and floor level. It is carried thence by conveyors to the hoppers above the boilers, to which it descends through the chutes by gravity. The ashes are taken from the pits and carried to hoppers above the tracks by conveyors, whence they are loaded into cars for removal.

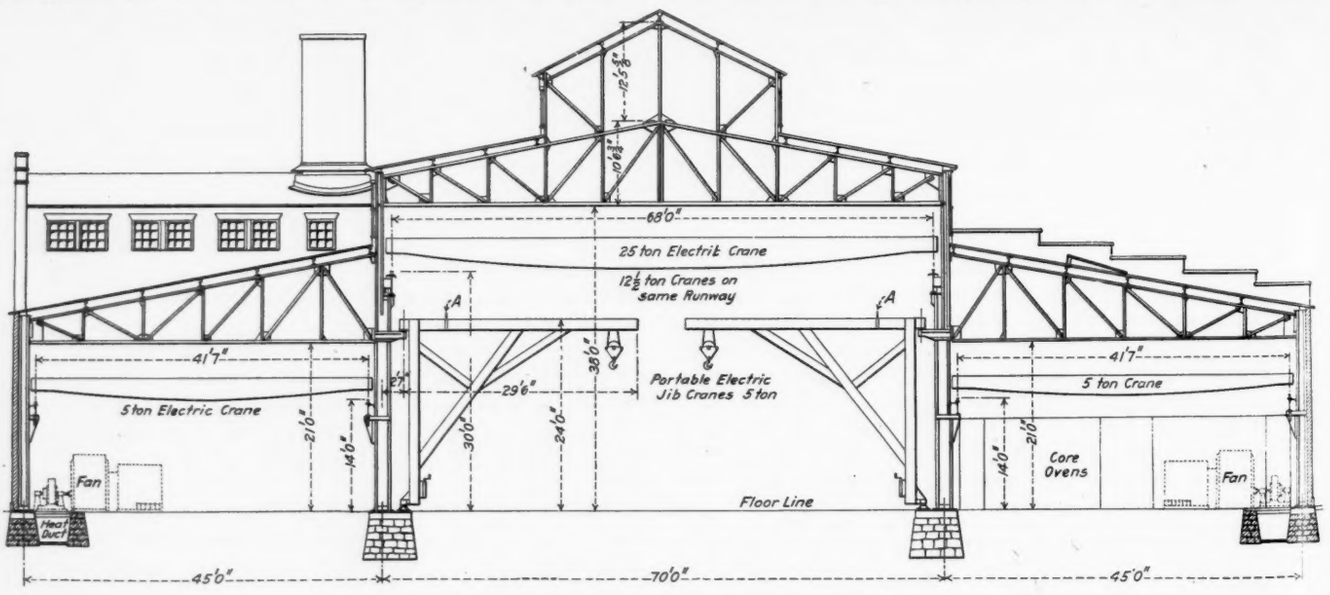
The machine shop is a one-story brick building 60 ft. by 98 ft. 3 in. that stands east of the power house. It is divided into three rooms, used respectively for electrical repairs, a smith shop and as a machine shop. The principal work of the machine shop is that of making repairs and finishing car wheel chills. For the latter there is an equipment of boring



Cross Section of Extension of Altoona Soft Iron Foundry.

mills and a number of saws for cutting the segments of the contracting chills. These chills are of the original simple form designed at the wheel foundry, and in which the inner ring is cut into a number of segments. The arrangements for sawing these chills is very simple and effective. The chill is carried on a roller bolted to a strong iron framing, so that it can be turned as each kerf is cut, so as to bring the proper point beneath the saw, when it is clamped fast. The saw is merely a No. 4 hack shop saw, placed back of the framing and arranged to cut down through the ring.

The last building of importance to be considered is the



Cross Section of the Altoona Soft Iron Foundry.

wheel foundry. It is a steel frame building with brick walls 602 ft. long and 188 ft. 1 in. wide. In the arrangement a longitudinal section would give a cross section of the roof trusses, as the bays extend athwart the building, as will be seen from the general view and the line engraving of the roof trusses. The bay containing the cupolas is higher than the adjoining ones, but aside from this there is no difference. The span of each truss from center to center of supporting columns is 46 ft. At the ends of the building there are three of these bays beyond the extreme cupolas. The first is used as a molding floor, the second spans the annealing pits and the third the cleaning floor. In the engraving the cupolas with the charging floor are shown at the right, then the next bay is split so that one-half (that at the right) shows the arrangement of the wheel transfers, of which there are four in each bay; and the other half (that at the left) the arrangement of the annealing pits, and the rail for the traveling crane.

This wheel foundry is one of the largest in the country, and was one of the first to use the straight wheel floors working in parallel lines. There are nine bays devoted to the molding, and each contains four floors with a capacity of 28 wheels to the floor, so that the capacity of the whole foundry is 1,008 wheels. They are spaced on 11-ft. centers and each is served by an overhead traveling electric hoist, by which the hot metal is brought to the mold and the wheel carried away. There are six cupolas with shells 86 in. in diameter that are lined to 66 in., and with a capacity of 12 tons each per hour. They are set up in pairs, one of which is at the center of the building, and the others 138 ft. on either hand. The two ends of the building are duplicates of each other. The end bays are used as cleaning floors, and those next are occupied by the annealing pits, which are served by a traveling pitting crane of 4,000 lbs. capacity. The pits are arranged in four rows, with 25 in a row, and each pit will hold 22 wheels, so that the total capacity of the whole is 4,400 wheels.

The material starts in the storage yard. It is first taken to the scale house for weighing. The details of the scale house and the proportions of metal charged will be presented later in connection with the details of the wheel manufacture, from a metallurgical standpoint. The old wheels and scrap are broken under a drop near the scale house, and from this point both fuel and metal are taken to the cupola in narrow gage cars on an industrial railway. The breakers are operated by a hydraulic lift and have a drop of 15 ft. The pig metal is stored in piles alongside the tracks, each brand being kept by itself, though no attempt is made to separate the carload lots. Coke is stored in the bins beneath the trestle, so that all materials are conveniently at hand.

The cupola room is in two stories, the upper one, or charging floor, being reached by a hydraulic elevator, from which the cupolas are charged by hand, and to which the narrow gage cars of material are raised. The lower floor is partly occupied by the blowers which are located in a space partitioned off in one corner. The blast is furnished by six blowers, in this respect each cupola being separate and distinct from the other, which deliver the air under pressure of about 14 in. of water, each being driven by a 60-h.p. motor. This blast, in connection with the proportions of coke and metal given later, melts about seven lbs. of iron to one of fuel. A record of one day's run was that of 365 tons of metal, melted with 103,800 lbs. of coke, which is an insignificant trifle above the figure given.

The core benches and ovens are between the cupolas at one side and the sand storage occupies a similar space on the other side of the center cupolas. The core ovens are in two sets of the revolving type carried on a center shaft running on ball bearings, each with seven shelves that can be turned independently, and each shelf capable of holding 14 ring cores. These ovens have their grates below the floor level, and the hot air is led through flues to the further back corner of the oven, where it rises and passes up through and around the shelves at the back and top, and is then brought back to the floor again for the outlet in the lower front corners. There is also an outlet near the roof of the oven that can be used if desired.

Interior of Soft Iron Foundry.

The cores are made of sharp sand and flour, of which latter about six barrels are used per day.

When the cupola is tapped the metal flows first into a mixing ladle of about seven tons capacity. It has an overall height of 5 ft. 3 in. and a diameter of 4 ft. 5 in. outside the shell and inclusive of the lining.

It is carried at about its center line by trunnions resting in substantial floor stands, and is tilted by means of a hydraulic cylinder placed beneath the frame. At the end of these trunnions, and outside the bearings there is a chain wheel, from which the operating chain passes down and over a sheave to the piston rod of the hydraulic operating cylinder. One of these chains passes down at the front and the

other at the back of its respective wheel, so that their action is reciprocal and one is being wound up while the other is paying off. The piston rod of the cylinder extends out at each end and terminates in an eye to which the ends of the chains are attached. It is evident that as the piston is moved in one direction or the other by the admission of a water pressure to a corresponding end of the cylinder, the ladle will be tilted accordingly.

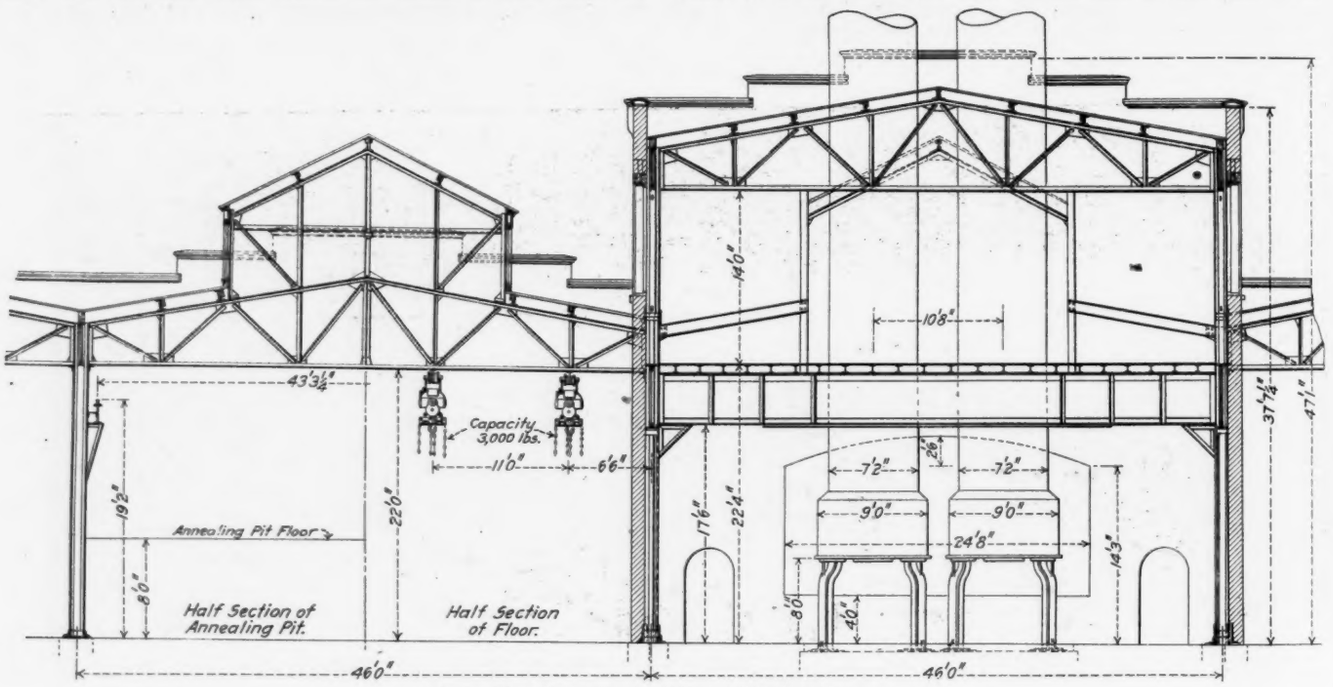
The ladle is manipulated by an attendant at the cupola, who, by means of a lever, manipulates the valve by which the water is controlled. This man stands alongside the ladle, so that every motion is clearly seen. The ladle is so located that it can be tilted to fill the pouring ladles whie metal is running into it from the cupolas, so that there need be no interruption to the work of either pouring or tapping.

When the apparatus was first installed it was feared that there might not be a sufficiently sensitive control, and that there would be danger of spilling. But this fear has proven to be entirely unfounded, for nothing could exceed the delicacy and precision with which the metal is run from the reservoir into the pouring ladles and the former returned to its holding position.

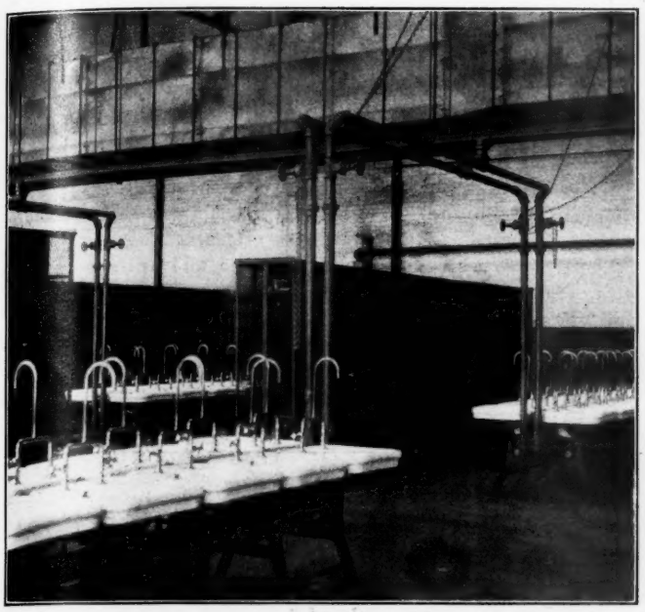
The metal is received from the mixing ladle in the pouring ladles which are set on cars and run in front of it. These cars are hauled to and fro by a cable that is driven by an overhead motor. The general scheme is shown by the accompanying engraving. There are four cars on the ground track, each capable of holding two pouring ladles. The cars are so spaced by their couplings that the distance between centers of the corresponding ladle pockets on two adjoining cars is 11 ft. or that between the wheel floors. There are four cars in a train, so that when it is stopped the cars stand in line with the overhead electric hoists serving four consecutive floors. The cable passes along between the tracks up at one end of its run over idlers to the motor drums, and then on and down at the other end over tightening sheaves and back to the cars. The motor is reversible, is under the control of a special operator and hauls the cars at a speed of about 900 ft. per minute.

The cars are made of steel and, as stated, have an accommodation for two ladles, although never carrying but one filled at a time. The object is to make it possible to stop in front of a floor, receive an empty ladle and then, by moving on 2 ft. 8 in., the distance between ladle centers, be in position to deliver a full ladle for the next pouring.

The sills of the car are 6-in. channels, weighing 8 lbs. per foot, and the body is of 5 in. by 3 in. angles bent to the form shown, for the rim, and rivetted to a ⅜-in. plate for a floor. The wheels are 15 in. in diameter and loose on the axle. The construction of this wheel is shown in the detail engraving. The body of the axle is rectangular (3 in. by 2½ in.) and is turned down at the end to 1½ in. by 5 in. journals. The wheel is of cast iron bored out to 2¼ in., and has a brass bushing (A) forced in. The wheel does not come to a bearing all around the bushing, but has four short spokes projecting inwardly from its own hub, which, with the closing down of the metal full at the back, forms four cavities (B), between the bushing and the wheel hub. Oil holes are drilled in the bushing, so that grease in the cavity has access to the journals. Between the flange at the back of the bushing and the shoulder on the axle there is an iron washer (C), which serves as a dust guard. The wheel is held in place by a collar and pin (D) on the end of the axle. The oil box is formed by screwing the cap (E) on to the outside of the wheel hub and pinning it so that it cannot get loose. A ¼-in. pipe plug closes the hole cap, through which oil or grease is supplied to the oil cavity. The bearing is thus protected against the entrance of grit in this very dusty atmosphere. The rails upon which these cars are run are the 20-lb. industrial rail. Over each floor there is an I-beam trolley, with a traveling hoist, as shown on the longitudinal section of the building. These hoists are driven by an electric motor and can be made to hoist or traverse by a single handle from the floor. The hoisting speed may be made to vary from 16 ft. to 75 ft. per minute, and the traversing up to 400 ft. per minute. The capacity of the lift is 1,000 lbs. at 60 ft. per minute. Each hoist is fitted with two controllers, one for lifting and the other for traversing. There is a projecting arm fastened to the frame which carries a hollow shaft that is connected to one controller. At the outer end of this hollow shaft there is a bevel gear that meshes with another at the upper end of a vertical rod, which runs down to the controller handle, and on the inside of the hollow shaft is a horizontal arm connected to the horizontal controller handle at the lower end of the vertical shaft by two wires. Hence by tilting the controller handle the wires rotate the

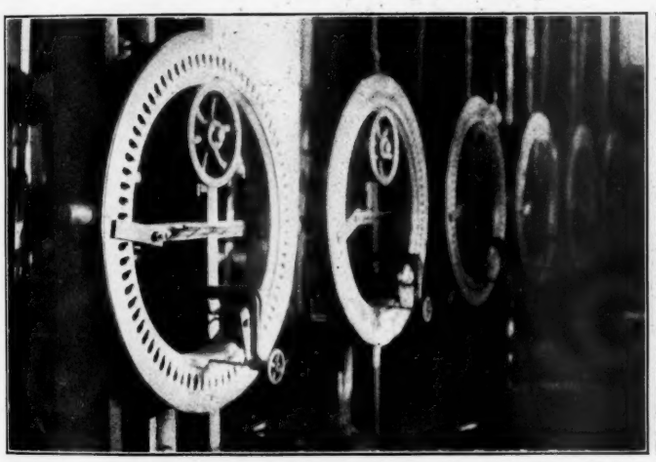


Cross Sections of Altoona Wheel Foundry.



Washroom; Altoona Foundries.

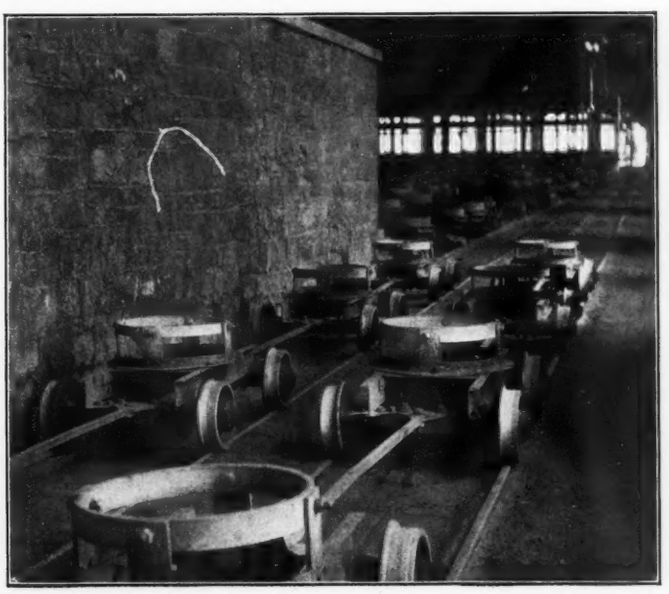
Annealing Pits.



Sawing Contracting Chills; Altoona Wheel Foundry.

Interior; Altoona Wheel Foundry.

Locomotive Crane with Magnet Lift; Altoona Foundries.



Hot Wheel Cars.

inside shaft and the hoist motor is started, and then by turning the controller handle horizontally, and with it turning the vertical shaft, the outer horizontal shaft is rotated by means of the gears and the traverse motor is started.

It is evident that both these operations can be carried on at the same time, and it developed that after a little practice the men became very expert in handling the ladles and wheels.

The overhead tracks extend out beyond the limits of the floors in each direction. On one side they make it possible for the hoists to pick up the ladles from the cars and carry them to the molds. On the other, after the molds have been shaken out, they pick up the hot wheels and carry them to the cars that are to carry them to the annealing pit.

The arrangement for transferring the wheels to the annealing pits is similar to that used for handling the hot metal in the pouring ladles from the cupola. There is the same arrangement of cable haulage, the difference being in the details of the cars. As in the other case, these are coupled into trains of four, spaced so that the wheels are 11 ft. between centers corresponding to those of the floors. In this case the sills are of 5-in. channels, carried on the same type of axle and wheels as before. There is no true car body, but in its place there is an elevated ring carried by a framework, and it is on this that the wheel rests. This raises it sufficiently to make it convenient to break off the sprue and drive out the core before delivery to the lifting tongs of the pitting crane. In order that the track may not be blocked by the sand of the cores, a chute (A), made of 3-16-in. steel, is placed beneath and at such an inclination as to deliver the sand, as it falls from the wheel, off on one side and clear of the rails.

It will be noticed that in both of these cars the flanges of the wheels are upon the outside of the rails, instead of between them in the ordinary way. This has been done so as to put all of the lateral thrust of the car against the brass wearing collar that is inside the holding one at the end of the axle, instead of against the inner shoulder of the axle. This relieves the leather dust guard of all wear and makes it possible to retain a tight joint at that point, which would not be possible if it had to sustain all of the thrust. Further than this, it puts this thrust collar in an oil chamber, where it is sure of constant and thorough lubrication.

As will be seen from the plan of the buildings, the hot wheel truck runs along the west wall at the end of the annealing pits. When the cars reach this point the wheels are lifted off by a pitting crane having four hoists, spaced 11 ft. between centers to correspond with those of the cars and the rows of pits.

Each hoist is provided with a pair of ingenious pitting tongs, by which the wheel can be lifted from the cars, lowered to the pits and automatically released.

These tongs were designed at Altoona and are shown herewith. The full lines show the disposition of the parts when the tongs are being lowered to pick up a wheel, except that the handle (A) is turned to the dotted position. When so disposed, the lifting eye (B), with its rod, by which connection is made to the upper links (C) of the toggle, is down. The long arms (DD) are pushed out, and as they are pivoted at (EE) the lower ends (FF) are drawn together so that they will readily enter the hub of a wheel. The arms are held in this position by the bell crank (G), which has a hook at its upper extremity that engages a pin on the eye connection, and which is guided by the slot in the frame above it.

Interior of Pattern Shop.

The tongs are then lowered. The ends (FF) go down into the wheel until the loose bolt (H) strikes the hub. It is pushed up and, in this movement, it strikes the horizontal arm of the bell-crank (G) and raises it. This throws the hook at the upper end out of gear with the pin and frees it. The hook and bell crank, meanwhile, turning about the pivot and striking the separating bolt at the outer end of its guide (I), where it remains.

Then, by lifting on the eye the toggle is closed to the dotted position, the lifting ends are separated, and, grasping the wheel, lifts it from the car. The crane then carries it to the pit. Here an attendant throws the latch (H) over to the right and its short stem is held by the weight of the overhanging handle against the pin (K).

When the wheel is lowered to the bottom of the pit, the weight being removed, the toggles drop to the full line position and the catch (A) drops by gravity over the pin (K),

and holds the tongs in that position, so that, when they are raised, they remain closed and the wheel is left in the pit. As the tongs are raised from the pit the bell crank hook (G) is thrown back into the position shown, and to the dotted position, when the tongs are ready to lift another wheel from the cars. This requires one attendant at the pit top to throw the hooks, but as such an one would be required in any case to steady the wheels as they are lowered, no extra expense is involved. There is, of course, an attendant in the cage of the traveling crane.

After annealing the wheels are picked out of the pits in the same manner and transferred to the cleaning floor. The crane itself has a capacity of 4,000 lbs., and is driven in its transverse motion by a 10-h.p. motor at a speed of 500 ft. per minute. The hoists have a 7½-h.p. motor back, and lift at a speed of 100 ft. per minute. A spare hoist is also provided, so that the work need not be interrupted by the failure of any one of the regular four.

The arrangements of this whole system of transfer is such that from the time pouring begins until every mold is filled all of the cars and mold hoists are continually busy. Then, after pouring, and when the shaking out has commenced, the mold hoists and the hot wheel route is busy without a stop.

The top of the annealing pits is raised 8 ft. above the floor of the foundry and the bottom is 8 ft. below the same. They are made of ⅜-in. plates bent to a cylinder 40 in. in diameter which is given a lining of 6 in. of firebrick. As already stated, they are set in rows 11 ft. apart, with an 18-in. spacing between the pits of each row. Each is provided with a cast iron cover, which, in turn, is covered with sand when the pits are full.

After cleaning the wheels are rolled out to the long platform on the west side of the building. This platform is of the same height above the tracks as the floor of a car, so that loading is easily accomplished by rolling the wheels into place.

The building is remarkably well lighted. There is a monitor on the roof of each section, which is wide and high and is fitted with swinging sash at the side, which causes a circulation. In addition to this there is a skylight in each monitor for its whole length, while the side walls are provided with large windows occupying a large percentage of the space.

The building is heated by hot air. The air is delivered by two 10-ft. fans across the steam coils and into galvanized iron ducts, the openings of which are 8 ft. above the floor and directed downwards.

There are two wash rooms, of the same style and type as that in the soft iron foundry, already described, with porcelain basins, expanded metal lockers and shower baths.

Outside the yards are equipped with ample lighting facilities for night work.

Thus far the physical aspects of the wheel making have been considered. The metallurgical side of the question is of equal importance and will now be taken up.

The present method of wheel making on the Pennsylvania is the result of a rather rapid development that took place a number of years ago. It is well known that though sulphur and manganese have a hardening effect on cast iron, the silicon is really the controlling element in the formation of the chill. If the silicon is too high, say above .80 or .90 per cent., the iron will not chill. It is, therefore, necessary that low silicon irons should be used for cast wheels. This may be called the basic principle, and for that reason the charcoal irons have been those used for the purpose, because they are low in silicon. They have the disadvantage of high cost, hence a substitute has always been looked for, and years ago the works used an anthracite iron made by Firmstone, who had developed a method of making it and keeping the silicon down to 1.25 per cent. With this exception the anthracite irons could not be extensively used. Now, when it had been learned that low silicon was essential. Hamilton secured his patient for an admixture of steel rails with the iron for a car wheel. Its advantage was not that the steel of the rail would, of itself, add anything to the strength of the wheel, but it was argued that as a low silicon iron is needed for the wheel, it can be obtained by mixing a pure iron free from that element with the pig metal usually employed, and the purest metal available is steel, and the cheapest form in which it is available is an old rail, hence old

Machine Moulding Room.

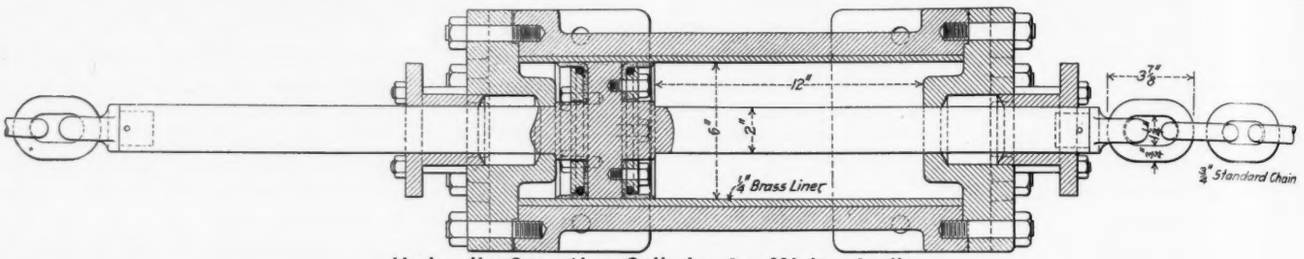
rails were used solely for the purpose of reducing the percentage of silicon content in metal where it would otherwise be too high for use. The efficiency of this method having once been demonstrated, it was adopted at the Altoona foundry and has been in use ever since.

The irons used are a mixture of coke and charcoal irons, to which is added old wheels and steel scrap. If rails are available for the last, they are used; if not, then other steel scrap answers as well. At one time it was the regular practice to add 10 per cent. of old rails to the charge, but as the irons with lower silicon content have become available this has gradually been cut down to 5 per cent. Take a recent charging ratio as an example. It consisted of

Steel (scrap or rails)	5 per cent.
Old wheels	55 "
New scrap	10 "
Richmond No. 3	5 "
Shelby No. 3	5 "
Swede (coke iron)	15 "
Antrim No. 3	5 "
	100 per cent.

Analyzing the above mixture, the steel consisted of old Bessemer rails of about .55 carbon or springs, boiler cuttings, steel castings or other scrap of varying silicon content from .10 to .30 per cent. In the old wheels the silicon is placed at about .55 per cent., though this is an estimate from general wheel records and not from specific analyses. New scrap consisting of sprues, heads, etc., is taken to be the same as the wheels, or at .55 per cent. for silicon. The pig irons are analyzed for general averages, and it is assumed that those of the same brand are of a practically constant composition. Analyses of those given in the above charge are for the Richmond No. 3.

Silicon	.61 per cent.
Sulphur	.03 "
Phosphorus	.53 "
Manganese	.13 "
Combined carbon (estimated)	.35 "



Hydraulic Operating Cylinder for Mixing Ladle.

Shelby No. 3.

Silicon	.78 per cent.
Sulphur	.015 "
Phosphorus	.32 "
Manganese	.64 "
Combined carbon (estimated)	... "

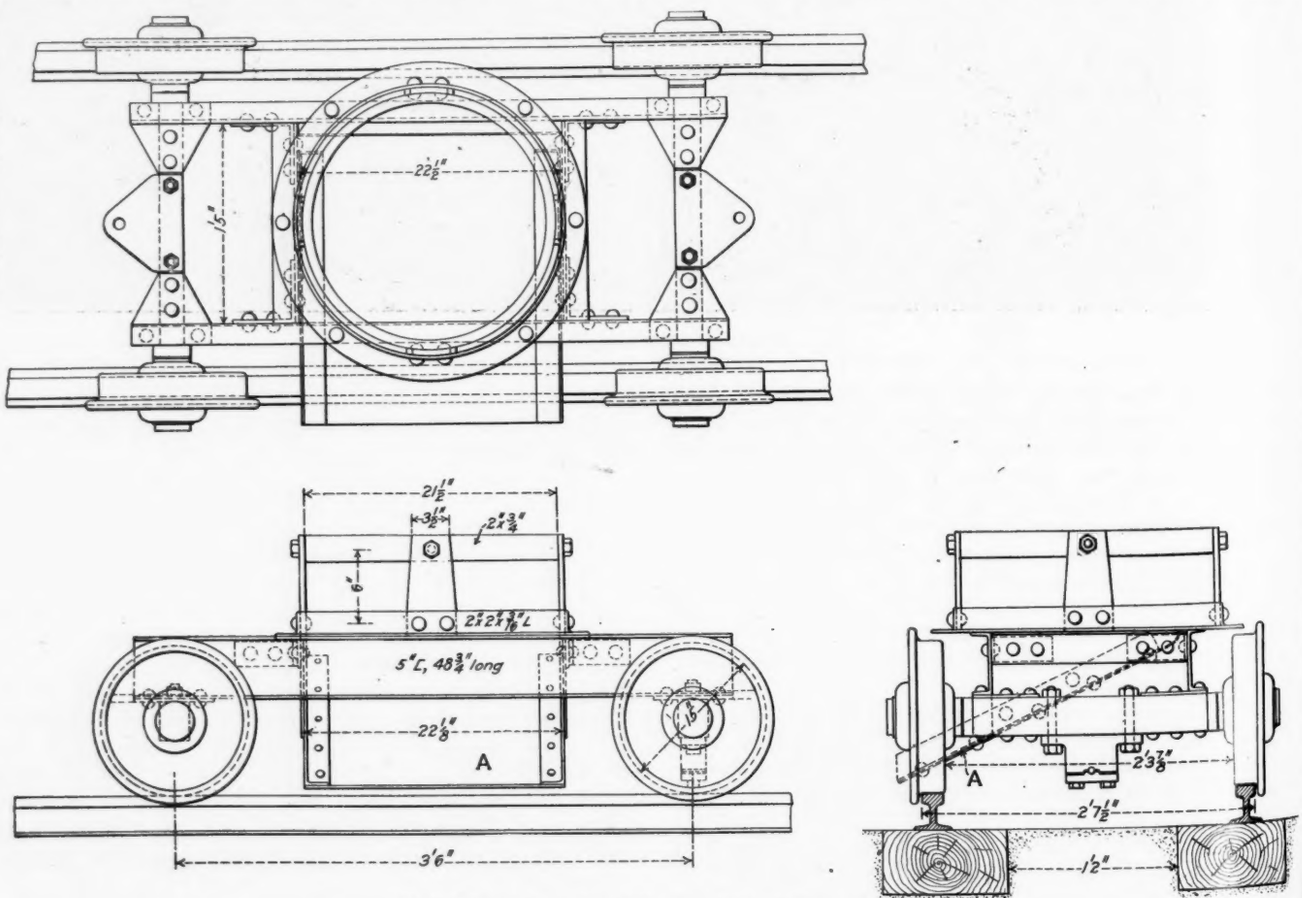
Antrim No. 3.

Silicon	.57 per cent.
Sulphur	.025 "
Phosphorus	.23 "
Manganese	.25 "
Combined carbon (estimated)	.65 "

The Swede iron has

Silicon	1.10 to 1.40 per cent.
Sulphur	.015" .03 "
Phosphorus	.45 " .55 "
Manganese	1.25 " 1.50 "
Total carbon, about	3.5 "

Of these the Richmond, Shelby and Antrim are charcoal



Hot Wheel Car for Altoona Wheel Foundry.

irons and the Swede a coke product; hence the charge may be revised so that it practically amounts to

Steel scrap	5 per cent.
Old wheels	65 "
Coke iron	15 "
Charcoal iron	15 "

And this may be taken as an average of current practice at South Altoona. The chemical composition of the wheels produced varies, of course, with the variations in the irons used, and there is, therefore, no fixed standard. An analysis of new wheels that may be taken as typical is as follows:

Total carbon	3.35 per cent.
Graphitic carbon	2.68 "
Combined carbon	.67 "
Silicon	.60 "
Sulphur	.137 "
Phosphorus	.344 "
Manganese	.529 "

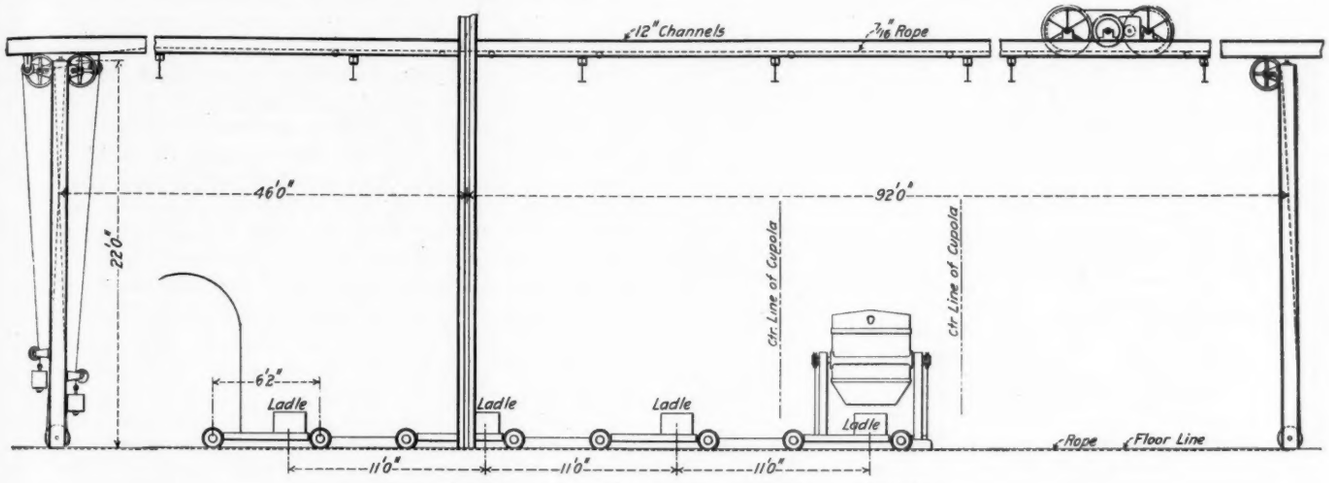
As affecting the chill, the sulphur and manganese above certain limits have a hardening effect, the silicon a softening, while the phosphorus is probably inert.

In the melting the cupola is first made up with a bed of 3,500 lbs. of coke. The charges are of 8,000 lbs. each, with 900 lbs. of coke between.

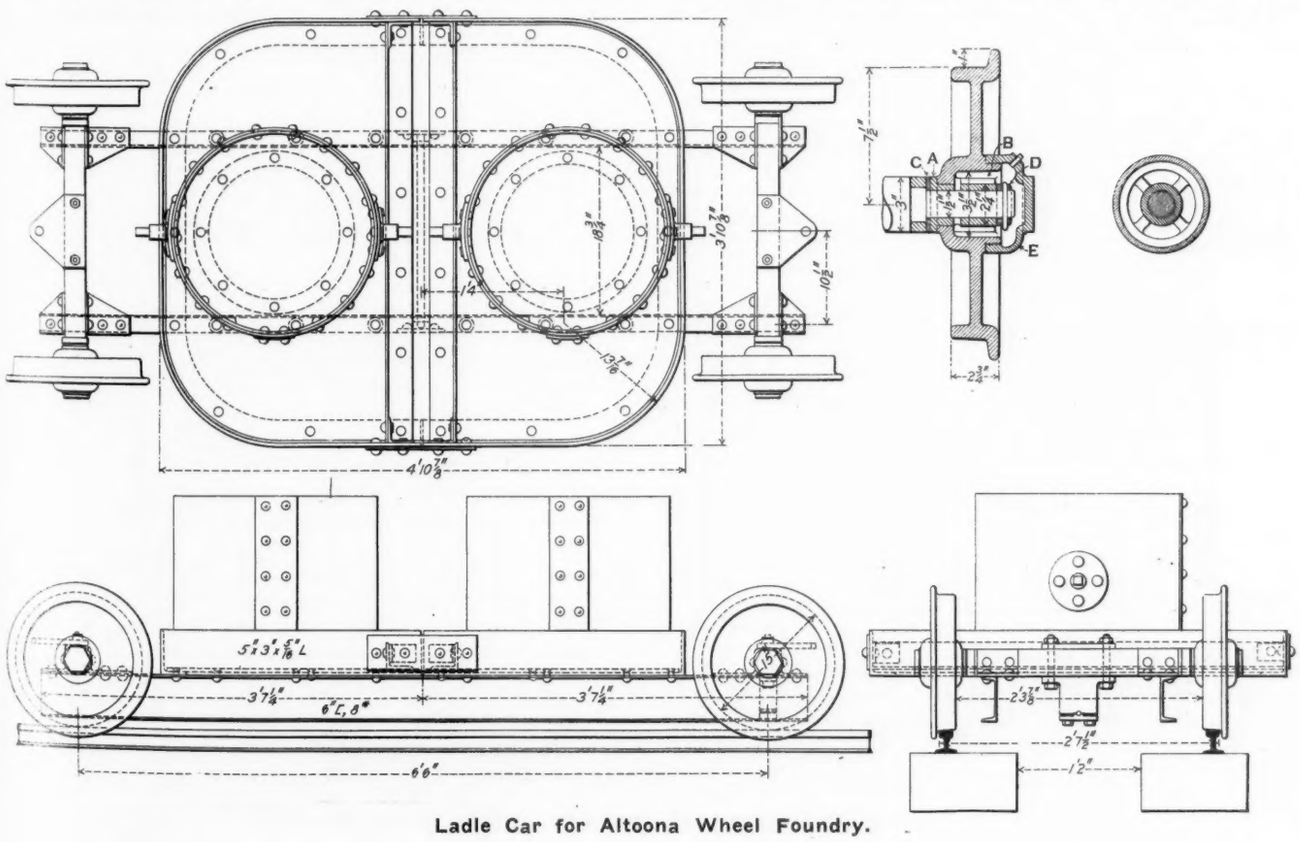
The coke used is the 72 hours, and most of it comes from west of the Alleghanies. Of course, the Connellsville is preferred, but is not always used. The main point looked after in the selection of the coke is to get a quality as low in sulphur as possible. If it does not go above .90 per cent. it is not objectionable, but if it goes higher there is apt to be trouble, and when it climbs up to 1.10 per cent. it is decidedly objectionable. The reason for this is that a large proportion of the sulphur in the coke is apt to get into the iron, and that it does not all do it is due to the fact that it does not all come into contact with the metal.

In order to keep the slag quite soft and liquid from 80 lbs. to 100 lbs. of lime stone is put in the cupola with each charge of four tons of metal. Other than this nothing goes in at the charging door but the metal and the fuel.

The limestone is put in directly on top of the coke, and

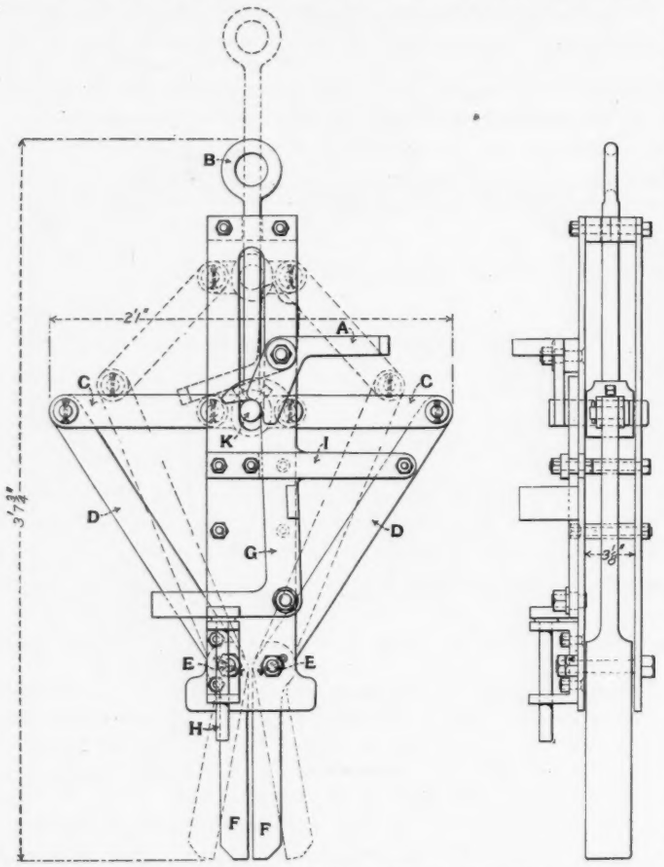


Rope System of Haulage; Altoona Wheel Foundry.



Ladle Car for Altoona Wheel Foundry.

in addition to its fluxing quality of keeping the slag fluid so that it flows out very freely without any tendency to stiffen as would otherwise be the case. It also serves the purpose of taking up a portion of the sulphur, and thus preventing it from becoming incorporated with the iron.



Pitting Tongs; Altoona Wheel Foundry.

When the molten metal is poured from the mixing ladle into the pouring ladles, each of which holds about 800 lbs., at least one pound of powdered ferro-manganese is added. Sometimes it is thrown into the bottom of the ladle before filling and sometimes upon the surface of the molten metal. In either case the diffusion is sufficiently rapid to accomplish the purpose of raising the manganese content of all of the metal of the wheel by the desired amount. The quantity added is not weighed, but is put in in accordance with the judgment of the ladle man and may vary from 1 lb. to 2 lbs., for from 1½ lbs. to 2 lbs. is not considered at all objectionable. It is to be understood that no ferro-manganese is put in the cupola, and no ferro-silicon is used at all in the regular practice. The aim is merely to get about .60 per cent. silicon in the new wheels. No malleable scrap is used: in fact, nothing except the steel in the way of outside scrap.

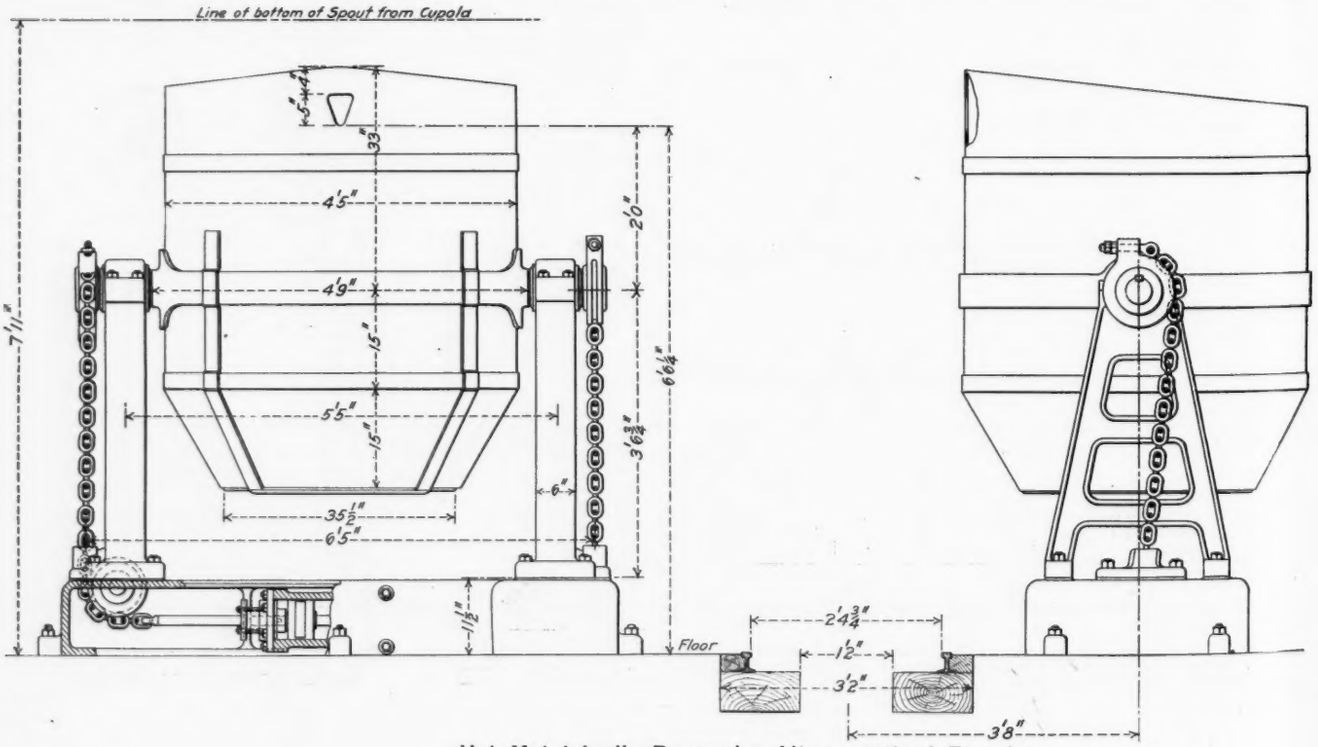
In order to keep track of what is going on a chill test is made from every tap. The metal is caught in a hard ladle as it is flowing down into the mixing ladle, and so represents what is flowing from the cupolas at the time, and not what may be actually sent to the wheels in the pouring ladle, as the mixture may be modified in its passage through the mixing ladle. These chill tests are used to determine, on the spot, what amount of ferro-manganese should be added, and also offers the opportunity of changing the character of the mixture should occasion arise.

In addition to these chill tests three test bars 1½ in. sq. are taken from each pair of cupolas, making nine in all. One of these is chilled and the other two unchilled. These are sent to the laboratory for testing.

COST OF LOCOMOTIVES BUILT IN AUSTRALIA.

A return showing the cost of the class P engines built in the railway workshops at Sydney was recently presented before the New South Wales legislature assembly. These are 6-wheel-coupled heavy mail and express engines, weighing, with tender, 163,128 lbs. The details are stated in the accompanying table, taking pounds sterling to dollars at 4.87.

The figures are interesting when compared with the estimates made five years ago, when a royal commission sat in Sydney to inquire into the manufacture of locomotives by the government, or by private enterprise, in the state. Esti-



Hot Metal Ladle Reservoir; Altoona Wheel Foundry.

mates were submitted for 30 "P" class and 30 "T" class engines, and the commission, by majority, reported that in their opinion the 60 engines should be produced in the Eveleigh (Sydney) workshops at an average price of about £62 ($301.94) per ton of 2,240 lbs. This, *prima facie*, compares

Details of Locomotive Costs.

	Cost		
Direct charges:	10 engines.	Per engine.	Per ton*
Materials	$117,462.77	$11,746.28	$161.29
Wages	76,484.23	7,648.42	104.99
Total	$193,947.00	$19,394.70	$266.28
Indirect charges:			
Percentage of shop charges (exclusive of superintendence) on wage-basis in each shop, 37.84 per cent.	$28,943.79	$2,894.38	$39.74
Superintendence, on wage-basis, 3 per cent.	2,294.51	229.45	3.10
Interest on capital cost of new shop and machinery, incldg land	4,850.52	485.05	6.63
Proportion of interest on capital cost of old shops on locomotive work produced for new engines.	5,449.53	544.95	7.45
Depreciation of machinery and plant; 2 per cent. on capital cost	5,149.99	515.00	7.03
Total indirect charges	$46,688.34	$4,668.83	$63.95
Total charges	$250,635.34	$24,063.53	$330.23

*Ton of 2,240 lbs.

favorably with the cost of engines under manufacture by private enterprise in this state, by the Clyde Engineering Co. This company in 1905 was given a contract for the supply of 30 "P" class and 30 "T" class engines (a subsequent order being given for a further 15 "P" class engines) at the rate of £71 13s. 11d. ($349.11) per ton.

FOREIGN RAILWAY NOTES.

A railway lately finished to Kagoshima on Kiushiu, the most southerly island of Japan, completes a through line of about 2,000 miles running the whole length of the country from Hokkaido on the northeast to Kiushiu on the southwest. It is all rail except for ferries between Moji and Shimonoseki, and between Aomori and Makodate.

Rights have been granted for building a line from Diamante harbor, Argentine, via Curuza Cuatia, to Posadas on the Monte Caseros line; also a line from Parana harbor joining the above line near Maria Grande. Authority has also been given to connect branch lines with existing railways in the provinces of Entre Rios and Corrientes.

TOOL LAY-OUT FOR THE SCRANTON SHOPS OF THE DELAWARE, LACKAWANNA & WESTERN.

In the description of the new shops that are being built for the Delaware, Lackawanna & Western at Scranton, Pa., published in the *Railroad Age Gazette* Nov. 5, attention was called to the care that was taken in the selection of the tools. For this purpose a committee was appointed that analyzed and classified all the work that is to be done in the repairing of 30 locomotives and the building of four new ones each month. In this, each item was taken up in detail; the time required for its performance ascertained, and the proper tool for doing it selected. This gave a clear, definite basis upon which to act, and the choice of tools has been made accordingly. Through the courtesy of T. S. Lloyd, superintendent of motive power, the schedule prepared by the committee is here reproduced.

It shows the new tools that were required at the opening of the shop, as well as the additions that will be needed when it is brought up to its full capacity. Attention is called to the elaborate method of procedure in which each piece is given its own proper place in the arrangement of the month's work. This is perhaps the most thorough analysis of the kind that has ever been made, and should have value for reference purposes in every large railway shop in the country.

DRIVING WHEELS AND TIRES.

	1 (A) *Turning Tires.*	
1—80-in. D. W. Lathe 80-in. Niles-Bement-Pond New Model.	Turning, miscellaneous, 8 x 4	32
	Repairs, 30 x 4	120
		152 prs. pr mo.
	Average time, 1½ hrs. pr pr = 28⅜ days' work	
	(B.) *Truing Journals.*	
1—D. W. Lathe.*	Truing Journals, 152 x 50%	76 per month.
	Average time, 2½ hrs. = 24 days' work.	
	(C) *Boring Tires.*	
1—7-ft. Vertical Boring Mill.*	New engines, 4 x 8	32
	Repairs, 50 x 8 x 15%	36
		68 per month.
	Av. time, 40 mins. per tire = 5⅔ days' work.	
	Smoke arch rings new engines, 4 x 1	4
	Repairs, 30 x 10%	3
		7 per month.
	Av. time, 2½ hrs. per ring = 2⅛ days' work.	
	Total, 5⅔ + 2¼ = 7¹¹⁄₁₂ days' work.	
	(D) *Quartering Wheels.*	
1—Quartering Machine.*	New engines, 4 x 4	16
	Repairs, 50 x 4 x 10	12
		28 prs. pr mo.
	Average time, 3 hrs. per pr = 10½ days' work.	
	(E) *Wheels Centers.*	
1—7-ft. Vertical Boring Mill. 84-in. Niles-Bement-Pond Extra Heavy Boring and Turning Mill.	New engines, 4 x 8	32
	Repairs, 30 x 8 x 5%	12
		44 per month.
	Average time, 8 hrs. = 44 days' work.	
	N. B.—See tire boring mill, 7¹¹⁄₁₂ days; Boring tires, 7¹¹⁄₁₂ + 44 days = 51¹¹⁄₁₂ ÷ 26 = 2 machines.	
1—400-ton Wheel Press.*	Tire boring mill available for wheel centers.	
	2 (A) *Frames—Planing.*	
1—Planer, 72 in. x 32 ft. (4 heads). Niles-Bement-Pond Standard Planer to plane 84 in. in width, 72 in. under cross rail, and 32 ft. in length.	New engines, 4 x 2	8
	Repairs, 30 x 2 x 3%	2
		10 per month.
	Av. time, 16 hrs. per frame = 20 days' work.	
	Front frame rails (new engines), 4 x 4	16
	Repairs, 30 x 4 x 5%	6
		22 per month.
	Average time, 5 hrs. = 15¾ days' work.	
	Total, 33¾ days' work.	
	(B) *Frames—Slotting.*	
1—2-Head Frame Slotter (4 per setting). 2-Head William Sellers Frame Slotter, 24-in. stroke, Length of bed 40 ft. (four frames per setting).	New engines, 4 x 2	8
	Repairs, 30 x 2 x 3%	2
		10 per month.
	Av. time, 15 hrs. per frame = 10¾ days' work.	
	Front frame rails, new engines, 4 x 4	16
	Repairs, 30 x 4 x 5%	6
		22 per month.
	Average time, 5 hrs = 13¾ days' work.	
	Total, 10¾ + 13¾ days = 32½ days' work.	
	(C) *Frames—Drilled.*	
1—4-Head Frame Drill. No. 5 Harrington Multiple Frame Drill; three plain and one swivel head.	New engines, 4 x 2	8
	Repairs, 30 x 2 x 3%	2
		10 per month.
	Av. time, 15 hrs. per frame = 16¾ days' work.	
	Front frame rails, new engines, 4 x 4	16
	Repairs, 30 x 4 x 5%	6
		22 per month.
	Average time, 4 hrs., per rail = 11 days' work.	
	Total, 16¾ + 11 days = 27¾ days' work.	
	3 (A) *Axles—Driving.*	
1—Lathe, 32 in. x 14 ft. 6 in.*	Turn axles, new engines, 4 x 4	16
	Repairs, 30 x 4 x 25%	30
		46 per month.
	Av. time, 3 hrs. per axle = 17¼ days' work.	
	Engine Truck Axles.	
	Turn axles, new engines, 4 x 1	4
	Repairs, 30 x 1 x 25%	8
		12 per month.
	Average time, 2⅕ hrs. = 3⅕ days' work.	
	Tender Truck Axles.	
	Turn axles, new engines, 4 x 4	16
	Repairs, 30 x 4 x 25%	30
		46 per month.
	Average time, 1½ hrs. = 8⅝ days' work.	
	Total, 17¼ + 3⅕ + 8⅝ = 29⅛ days' work.	
	(B) *Cut Keyways in Driving Axle.*	
1—Double Keyway Cutter.	New Engines, 4 x 4	16
	Repairs, 30 x 4 x 25%	30
		46 per month.
	Average time, 1 hr. per axle = 5¾ days' work.	

* Indicates old machines.

4 (A) *Connecting Rods.*

1—Slab Miller, 48 in. x — ft., to mill 14 ft. in length.
Niles-Bement-Pond 43-in. Heavy Rod Milling Machine.

New engines, 4 x 8 16
Repairs, 30 x 8 x 5% 12
44 per month.
Average time, 6 hrs. per rod = 33 days' work.

(B) *Milling Hubs.*

1—42-in. Vertical Milling Machine.*

New engines, 4 x 6 24
Repairs, 30 x 6 x 5% 9
33 per month.
Av. time, 5 hrs. per rod = 20⅝ days' work.

Mill Fire Door Frames.

New engines, 4 x 1 4
Repairs, 30 x 1 x 40% 12
16 per month.
Average time, 3 hrs = 6 days' work.
Total, 20⅝ + 6 days = 26⅝ days' work.

(C) *Bore Rods.*

1—D. H. Rod Boring Machine.
Newton Duplex Locomotive Rod Boring Machine.

New engines, 4 x 6 24
Repairs, 30 x 6 x 5% 9
33 per month.
Average time, 2 hrs. per rod = 8¼ days' work.

(D) *Drill Rods and Straps.*

1—Extra Heavy High Duty Drill Press 44-in. Compound Table.

Average time. 4½ hrs. per strap and rod = 28⅛ days' work.

(E) *Slot Rods and Straps.*

Niles-Bement-Pond 50-in. Vertical Drilling Machine.
1—12-in. Heavy Slotter.
William Sellers 12-in. Slotter.

New engines, 4 x 2 8
Repairs, 30 x 2 x 10% 6
14 per month.
Back and main rod 14
Front end main rod 14
Main connection strap and rods for knuckle fit 14
42 per month.
Rods cut to length, 4 x 2 8
Repairs, 30 x 2 x 10% 6
14 per month.
Average time, 5¾ hrs. per strap—42 x 5¾ = 241½ hrs., or 30 days' work.

(F) *Plane Straps and Rods.*

1—Extra Heavy Planer, 4 heads, 30 in. x 12 ft.
Niles-Bement-Pond 36 in. x 26 in. x 12 ft. Heavy Planer; 4-belt drive, 4 heads.

Back end main rod straps, new engines, 4 x 2 8
Repairs, 30 x 2 x 10% 6
14 per month.
Main connecting straps, repairs, 30 x 2 x 7% ..... 4 per month.
Front end main rod straps, repairs, 30 x 2 x 7% ..... 4 per month.
Plain rods, new engines, 4 x 8... 32
Repairs, 30 x 8 x 3% 8
40 per month.
Plane 15 old rods per month.
Average time, per strap, 1½ hrs., 22 x 1½ ..... 4⅛ days.
Average time, new rods, 3⅓ hrs. per rod. 40 x 3⅓ ..... 16¾ days.
Average time, old rods, 1½ hrs. per rod. 15 x 1½ ..... 2 5/10 days.
Plane eccentric straps, repairs, 30 x 4 x 63% ..... 76 per month.
Average time, 20 mins. = 3⅛ days' work.
Total time. 4⅛ + 16¾ + 2 5/10 + 3⅛ days = 27 days' work.

(G)

1—Hydraulic Press for Bushings.
25-ton R. D. Wood Hydraulic Press Double Pump.

(H)

1—Lathe, 20 in. x 10 ft.*

Knuckle joint pins, new engine, 4 x 4 16
Repairs, 30 x 4 120
136 per month.
Av. time, 30 mins. per pin = 8½ days' work.
Knuckle pin bushings, new engines, 4 x 4 16
Repairs, 30 x 3 120
136 per month.
Average time, 30 mins. = 8½ days' work.
Wrist pins, new engines, 4 x 2... 8
Repairs, 30 x 2 60
68 per month.
Average time, 1 hr. = 8½ days' work.
Crank pin collars, new engines, 4 x 8 32
Repairs, 30 x 8 x 10% 24
56 per month.
Average time, 40 mins. = 4⅝ days' work.
Total time, 8½ + 8½ + 8½ + 4⅝ = 30 days' work.

* Indicates old machines.

5 (A) *Crank Pins (Turn).*

1—26-in. x 10-ft. Lathe.
27-in. x 10-ft. Lodge & Shipley Latest Improved Patent Head Lathe.

New engines, 4 x 8..... 32
Repairs, 30 x 8 x 10% 24
56 per month.
Av. time, 3½ hrs. per pin = 24¼ days' work.

(B) *Drill Crank Pins.*

1—Heavy High Duty 36-in. Drill, Compound Table.
Niles-Bement-Pond 40-in. Vertical Drilling Machine.

New engines, 4 x 6..... 24
Repairs, 30 x 6 x 10% 18
42 per month.
Average time, 2½ hours = 13⅛ days' work.
Drill guide bars, new engines, 4 x 4 16
Repairs, 30 x 4 x 10% 12
28 per month.
Average time, 49 min. = 2⅞ days' work.
Drill guide blocks, new engines 4 x 4 16
Repairs, 30 x 4 x 10% 12
28 per month.
Average time, 12 min. = 5½ hours' work.
Drill crossheads, new engines, 4 x 2 8
Repairs, 30 x 2 x 10% 6
14 per month.
Av. time, 15 min. per head = 3½ hours' work.
Drill shoes and wedges, new engines, 4 x 16..... 64
Repairs, 30 x 16 480
544 per month.
Average time, 18 per hour = 3¾ days' work.
Drill driving box cellars, Repairs, 30 x 8 x 20% ..... 48 per month.
Av. time, 15 min. per cellar = 1½ days' work.
New crosshead shoes or blocks drilled for old crossheads, 30 x 2 x 25% ..... 15 per month.
Av. time, 1 hr. per shoe = 1⅞ days' work.
Total time: 13⅛ days + plus 2⅞ days + 5½ hours + 3½ hours + 1½ days + 1⅞ days = 24¼ days' work.

6 (A) *Driving Boxes.*

1—Planer, 42 in. x 20 ft.
42-in. x 42-in. x 20-ft. Niles-Bement-Pond Planer, 4-belt drive.

Plane for new engines, 4 x 8... 32
Repairs, 30 x 8 x 10% 24
56 per month.
Av. time, 3 1-5 hrs. per box = 22½ days' work.

1—Planer, 42 in. x 10 ft.
42-in. x 42-in. x 10-ft. Niles-Bement-Pond Planer, 4-belt drive.

Plane old driving boxes, 30 x 8 x 90% .....216 per month.
Average time, 54 min. = 24 days' work.

(B)

1—37-in. Rapid Production Vertical Lathe (Bullard).*

Face new driving boxes, new engines, 4 x 8..... 32
Repairs, 30 x 8 x 10% 24
56 per month.
Average time, 1⅓ hours = 9⅓ days' work.
Turn brass for box fit, new engines, 4 x 8..... 32
Repairs, 30 x 8 x 75% 180
212 per month.
Av. time, 20 min. per brass = 8⅞ days' work.
Bore and turn piston valve bushings, 30 x 4 x 10% ..... 12 per month.
Av. time, 4 hrs. per bushing = 6 days' work.
Dome caps and auxiliary domes, new engines, 4 x 2 8
Repairs, 30 x 4 x 10% 12
20 per month.
Average time, 1½ hours = 3¾ days' work.
Total, 9⅓ + 6⅞ + 6 + 5¾ days = 28 days' work.

(C)

1—20-in. Draw Shaper (Morton).
32-in. Special Railroad Morton Draw Cut Shaper.

Shape driving box and brass and collar fit, new engines, 4 x 8 32
Repairs, 30 x 8 x 10% 24
56 per month.
Av. time, 3 1-5 hrs. per box = 22½ days' work.

(D)

1—37-in. Vertical Boring Mill.*

Bore and face driving box for axle fit, new engines, 4 x 8.. 32
Repairs, 30 x 8 240
272 per month.
Av. time, 44 mins. per box = 25 days' work.

(E)

1—20-in. Shaper Heavy Duty.*

Plane driving box cellars for box fit, new engines, 4 x 8.. 32
Repairs, 30 x 8 x 10% 24
56 per month.
Average time 30 min. = 3½ days' work.
Plane driving box brasses for box fit, new engines, 4 x 8.. 32
Repairs, 30 x 8 x 75% 180
212 per month.
Average time, 20 min. = 6⅞ days' work.

* Indicates old machines.

Plane engine truck brasses, new engines, 4 x 2 8
Repairs, 30 x 3 x 20% 18

26 per month.
Av. time, 20 min. per brass = 1⅛ days' work.
Plane column castings for tenders, new engines, 4 x 8.... 32
Repairs, 30 x 8 x 10% 24

56 per month.
Average time, 1½ hours = 10½ days' work.
Guides cut to length and shape clearance, new engines, 4 x 4. 16
Repairs, 30 x 4 x 10% 12

28 per month.
Average time, 1 hour = 3½ days' work.
Old guides, cut clearance, Repairs, 30 x 4 x 50% ..... 60 per month.
Average time, 30 min. = 3¾ days' work.
Total time, 3½ days + 6⅛ + 1⅛ + 10½ + 3½ + 3¾ days = 29¾ days' work.

(F)

1—3-ft. Radial Drill.* Drill boxes, new engines, 4 x 8.. 32
Repairs, 30 x 8 x 10% 24

56 per month.
Average time, 2½ hours = 17½ days' work.
Drill old driving boxes, repairs, 30 x 8 x 75% .....180 per month.
Av. time, 30 min. per box = 11¼ days' work.
Total time, 11¼ + 17½ days = 28¾ days' work.

7 (A) *Cylinders and Heads.*

1—Cylinder Boring Mill.* Bore for new engines, 4 x 2.... 8
Repairs, 30 x 2 x 10% 6

14 per month.
Average time, 8 hours = 14 days' work.

(B)

1—Planer, 54 in. x 15 ft.* Plane cylinders, new engines, 4 x 2 8
Repairs, 30 x 2 x 10% 6

14 per month.
Average time, 15 hours = 26¼ days' work.

(C)

1—Port Miller. Mills posts in cylinders.

(D)

1—5-ft. Radial Drill. 6-ft. Niles-Bement-Pond Radial Drill. Drill cylinders, new engines, 4 x 2 8
Repairs, 30 x 2 x 10% 6

14 per month.
Average time, 6½ hours = 11⅛ days' work.
Drill wheel centers for hub liners new engines, 4 x 8..... 32
Repairs, 30 x 8 x 5% 12

44 per month.
Average time, 40 mins. = 3⅝ days' work.
Drill cylinder heads (back) new engines, 4 x 2 8
Repairs, 30 x 2 x 10% 6

14 per month.
Average time, 2 hrs. = 3⅛ days' work.
Drill front cylinder heads, new engine, 4 x 2..... 8
Repairs, 30 x 2 x 20% 12

20 per month.
Av. time, 84 mins. per head = 3½ days' work.
Drill piston valve bushings, repairs, 30 x 4 x 10%.....12 per month.
Av. time, 4 hrs. per bushing = 6 days' work.
Total time, 11⅛ + 3⅝ + 3½ + 3½ + 6 days = 27¾ day's work.

(E)

1—50-in. Vertical Boring Mill.* Piston packing rings, new engines, 4 x 6 24
Repairs, 38 x 6 228

252 per month.
Average time, 20 mins. = 10½ days' work.
Front cylinder heads, new engines, 4 x 2 8
Repairs, 30 x 2 x 20% 12

20 per month.
Average time, 68 mins. per head = 2⅞ days' work.
Back cylinder heads, new engines, 4 x 2 8
Repairs, 30 x 2 x 10% 6

14 per month.
Average time, 4 hrs. per head = 7 days' work.
Send boxes, tap and base, new engines, 4 x 1 4
Repairs, 30 x 1 x 10% 3

7 per month.
Average time, 3 hrs. = 2⅝ days' work.
Engine truck tires, 30 x 3 x 11%..10 per month.
Average time, 3 hrs. = 3¾ days' work.
Dome rings, new engines, 4 x 1.. 4
Repairs, 30 x 1 x 5% 2

6 per month.
Average time, 2 hrs. = 1½ days' work.
Total time, 10½ + 2⅞ + 7 + 2⅝ + 3¾ + 1½ days = 28 days' work.

* Indicates old machines.

8 (A)

1—Lathe, 26 in. x 12 ft.* Piston rods turned for new engines, 4 x 2 8
Repairs, 30 x 2 x 50% 30

38 per month.
Average time, 4 hrs. = 19 days' work.
Turn piston valve stem, 30 x 2 x 10% ..... 6 per month.
Average time, 10 hrs. = 7½ days' work.
Total time, 19 + 7½ days = 26½ days' work.

(B)

1—Norton Gap Grinder.* Grind piston rods, new engines, 4 x 2..... 8
Repairs, 30 x 2 x 50%..... 30
Old rods ground, 30 x 2 x 50%... 30

68 per month.
Average time, 40 mins. = 5⅔ days' work.
Grind valve yokes, new engines, 4 x 2..... 8
Repairs, 30 x 2..... 60

68 per month.
Average time, 30 mins. = 4¼ days' work.
Total, 10 days' work.
N. B.—Balance of time available for wrist pins, etc.

(C)

1—Cottering Machine.* Keyways in piston rods, valve rods, crossheads, valve yokes, etc.

9 (A) *Guides.*

1—Horizontal Milling Machine, 22 in. 10 ft.* Mill guides, new engines, 4 x 4.. 16
Repairs, 30 x 4 x 7% 8

24 per month.
Average time, 4 hrs. = 12 days' work.
Mill old guides, 30 x 4 x 25%.... 30 per month.
Average time, 1 hr. = 3¾ days' work.
Mill links, new engines, 4 x 2.... 8
Repairs, 30 x 2 x 5% 3

11 per month.
Average time, 3 hrs. = 4⅛ days' work.
Mill rocker boxes, new engines, 4 x 2 8
Repairs, 30 x 2 x 10% 6

14 per month.
Average time, 2 hrs. = 5½ days' work.
Mill transmission bars, 30 x 2 x 10% ..... 6 per month.
Average time, 2 hrs. = 1½ days' time.
Total time, 12 + 3¾ + 4⅛ + 3½ + 1½ days = 24⅞ days' work.

(B)

1—80-in. x 20-in. Guide Bar Grinder. Grind for new engines, 4 x 4.... 16
Repairs, 30 x 4 120

80-in. x 20-in. Bridgeport Guide Bar Grinder. 136 per month.
Average time, 30 mins. = 8½ days' work.

(C)

1—Shaper, 16 in.* Shape guide blocks, new engines, 4 x 4 16
Repairs, 30 x 4 x 15% 18

34 per month.
Av. time, 35 mins. per block = 2½ days' work.
Plane axle keys, new engines 4 x 8 32
Repairs, 30 x 8 x 5%..... 12

44 per month.
Av. time, 30 mins. per key = 2¾ days' work.
Plane rod key and eccentric key, 4 x 8 32
Repairs, 30 x 8 x 25%..... 60

92 per month.
Average time, 20 mins. = 3⅞ days' work.
Plane frame key, 4 x 16..... 64
Repairs, 30 x 16 x 25% 120

184 per month.
Average time, 20 mins. = 7¾ days' work.
Plane brake hanger brackets, new engines, 4 x 4 16
Repairs, 30 x 4 x 20%..... 24

40 per month.
Average time, 1 hr. = 5 days' work.
Filling blocks, new engines, 4 x 2 8
Repairs, 30 x 2 x 10%..... 6

14 per month.
Average time, 1 hr. = 1¾ days' work.
Spring saddle, new engines, 4 x 6 24
Repairs, 30 x 6 x 30% 54

78 per month.
Average time, 20 mins. = 3¼ days' work.
Total time, 2½ + 2¾ + 3⅞ + 7¾ + 5 + 1¾ + 3¼ = 26⅞ days' work.

(D)

1—Lathe, 16 in. x 6 ft. Guide blocks turned for new engines, 4 x 4 16
Repairs, 30 x 4 x 15% 18

34 per month.
Average time, 1 hr. per block = 4¼ days' work.

* Indicates old machines.

Wrist pin washer, new engines, 4 x 2 8
Repairs, 30 x 2 x 25% 15

23 per month.
Average time, 30 mins. = 1½ days' work.
Turn throttle valves, new engines., 4 x 1 4
Repairs, 30 x 1 x 20% 6

10 per month.
Average time, 3 hrs. pr valve = 3¾ days' work.
Steam pipe joint rings, new engines, 4 x 5 20
Repairs, 30 x 5 x 35% 50

70 per month.
Average time, 1 hr. = 8¾ days' work.
Turn throttle valve shaft, new engines, 4 x 1 4
Repairs, 30 x 10% 3

7 per month.
Average time, 1 hr. = ⅞-day's work.
Turn throttle valve steam, new engine, 4 x 1 4
Repairs, 30 x 1 x 20% 6

10 per month.
Average time, 30 mins. & ⅝-day's work.
Exhaust nozzle tips, new engines, 4 x 2 8
Repairs, 30 x 2 x 20% 12

20 per month.
Average time, 40 mins. = 1¾ days' work.
Tank valve racks, new engines, 4 x 2 8
Repairs, 30 x 2 x 25% 15

23 per month.
Av. time, 45 mins. per rack = 2⅛ days' work.
Hand-hole covers, new engines. 4 x 1 4
Repairs, 30 x 1 x 50% 15

19 per month.
Average time, 30 mins. = 1¼ days' work.
Sand box shaft, new engines, 4 x 1 4
Repairs, 30 x 1 x 10% 3

7 per month.
Average time, 1 hr. = ⅞-day's work
Total time, 4¼ + 1½ + 3¾ + 3¾ + 8¾ + ⅞ + ⅝ + 1¾ + 2⅛ + 1¼ + ⅞ days = 25¾ days' work.

10 (A) *Crossheads.*

1—42-in. Vertical Boring Mill.*

Face both sides and bore wrist pin hole, new engines, 4 x 2. 8
Repairs, 30 x 2 x 7% 4

12 per month.
Average time, 8 hrs. = 12 days' work.
Rebore old wrist-pin holes, repairs, 30 x 2 x 20% ..... 12 per month.
Average time, 1 hour = 1½ days' work.
Bore and ream for piston fit, new engines, 4 x 2..... 8
Repairs, 30 x 2 x 7% 4

12 per month.
Av. time, 3 hours per head = 4½ days' work.
Bore and turn eccentric cams, new engines, 4 x 4..... 16
Repairs, 30 x 4 x 30% 36

52 per month
Average time, 1½ hours = 9¾ days' work.
Total time, 12 + 1½ + 4½ + 9¾ days = 27¾ days' work.

(B)

1—Planer, 30 in. x 8 ft.*

Plane crosshead, new engines, 4 x 2 8
Repairs, 30 x 2 x 7% 4

12 per month.
Average time, 4 hours = 6 days' work.
Plane old crossheads, repairs, 30 x 2 x 20% ..... 12 per month.
Average time, 1½ hours = 2¼ days' work.
Plane new blocks and shoes for old crossheads, repairs, 30 x 4 x 20% ..... 24 per month.
Av. time, 1 hr. 12 min. per shoe = 33-5 days' work.
Plane back cylinder heads, new engines, 4 x 2..... 8
Repairs, 30 x 2 x 10% 6

14 per month.
Average time, 9 hours = 15¾ days' work.
Total time, 6 + 2¼ + 33-5 + 15¾ days = 27 3-5 days' work.

11 (A) *Steam Chests.*

1—Planer, 36 in. x 12 ft. D. H. 36-in. x 36-in. x 12-ft. Niles-Bement-Pond Planer, 2-heads on cross-rail and one side head.

Plane chests, new engines, 4 x 2 8
Repairs, 30 x 2 x 17% 10

18 per month.
Av. time, 3 hrs. per chest = 6¾ days' work.
Plane steam chest covers and pressure plates, new engines, 4 x 2 8
Repairs, 30 x 2 x 17% 10

18 per month.
Average time, 2½ hours = 5⅝ days' work.
Plane old pressure plates and covers, repairs, 30 x 2 x 74% 44 per month.
Average time, 1 hour = 5½ days' work.
Plane valves, new engines, 4 x 2 8
Repairs, 30 x 2 x 10% 6

14 per month.
Average time, 4 hours = 7 days' work.
Plane old valves, 30 x 2 x 74%.. 44 per month
Average time, 20 min. = 1⅞ days' work.
Plane false seats, 30 x 2 x 17.. 10 per month.
Av. time, 2 hrs, 20 min. = 3 days' work.
Plane valve yokes, new engines, 4 x 2 8
Repairs, 30 x 2 x 10% 6

14 per month.
Average time, 30 min. = ⅞ day's work.
Total time, 6¾ + 5⅝ + 5½ + 7 + 1⅞ + 3 + ⅞ days = 30⅝ days' work.

(B)

1—3-ft. Radial Drill. 3-ft. Weston Radial Drill.

Drill and tap steam chests, new engines, 4 x 2 8
Repairs, 30 x 2 x 17% 10

18 per month.
Average time, 1 hour = 2¼ days' work.
Drill steam chest covers, new engines, 4 x 2..... 8
Repairs, 30 x 2 x 17% 10

18 per month.
Average time, 2 hours = 4½ days' work.
Drill pressure plates, new engines, 4 x 2 8
Repairs, 30 x 2 x 17% 10

18 per month.
Average time, 30 min. = 1⅛ days' work.
Drill piston valve cylinder heads, repairs, 30 x 4 x 5% ..... 6 per month
Average time, 1 hour = ¾ day's work.
Drill rocker boxes, new engines, 4 x 2 8
Repairs, 30 x 2 x 10% 6

14 per month.
Average time, 1 hour = 1¾ days' work.
Drill link brackets, repairs, 30 x 2 x 10%..... 6 per month.
Average time, 1 hour = ¾ day's work.
Drill eccentric cams, new engines, 4 x 4..... 16
Repairs, 30 x 4 x 30% 36

52 per month.
Average time, 1 hour = 6½ days' work.
Drill transmission bars..... 6 per month.
Average time, 2½ hours = 1⅞ days' work.
Drill transmission on bar hangers ..... 10 per month.
Average time, 30 min. = ⅝ day's work.
Drill lift shaft boxes..... 16 per month.
Average time, 1¼ hours = 2½ days' work.
Drill links, new engines, 4 x 2. 8
Repairs, 30 x 2 x 7% 4

12 per month.
Average time, 1¼ hours = 1⅞ days' work.
Drill eccentric cranks, new engines, 4 x 2..... 8
Repairs, 30 x 2 x 4% 2

10 per month.
Average time, 2 hours = 2½ days' work.
Total time, 2¼ + 4½ + 1⅛ + ¾ + 1¾ + ¾ + 6½ + 1⅞ + ⅝ + 2½ + 1⅞ + 2½ = 27 days' work.

12 (A) *Valves.*

1—Heavy Plain Horizontal Milling Machine, 14-in. x 6-ft. Table.
Milwaukee No. 3-B Plain Milling Machine.

Mill valves, new, 4 x 2..... 8
Repairs, 30 x 2 x 10% 6

14 per month.
Average time, 2 hours = 3½ days' work.
Mill false seats, 30 x 2 x 17% .. 10 per month.
Average time, 2½ hours = 3⅛ days' work.
Mill valve strips, 4 x 2 set..... 8 set.
Repairs 30 x 2 x 90% ..... 54 set.

62 set per mo.
Av. time, 1½ hrs. per set = 11⅝ days' work.
Mill keyway in lift shaft, new engines, 4 x 1 4
Repairs, 30 x 1 x 7% 2

6 per month.
Average time, 30 min. = ¾ days' work.
Mill union bars (Walschaerts), 4 x 2 8
Repairs, 30 x 2 x 4% 2

10 per month.
Average time, 35 min. = ¾ day's work.
Mill valve rod (Walschaerts), 4 x 2 8
Repairs, 30 x 2 x 4% 2

10 per month.
Average time, 1 hour = 1¼ days' work.

* Indicates old machines.

Mill slot in eccentric crank, 4 x 2 8
Repairs, 30 x 2 x 4%..... 2

10 per month.

Average time, 1 hour = 1¼ days' work.
Mill throttle lever quadrant, new engines, 4 x 1 4
Repairs, 30 x 1 x 20%..... 6

10 per month.

Average time, 2 hours = 2½ days' work.
Mill reverse lever latch, new engines, 4 x 1 4
Repairs, 30 x 1 x 20%..... 6

10 per month.

Average time, 2 hours = 2½ days' work.
Mill throttle latch, new engines, 4 x 1 4
Repairs, 30 x 1 x 20%..... 6

10 per month.

Average time, 15 min. = 5/16 day's work.
Mill reverse lever and throttle lever latch handle, new engines, 4 x 2 8
Repairs, 30 x 2 x 20%..... 12

20 per month.

Average time, 12 min. = ½ day's work.
Total time, 3½ + 3⅛ + 11⅝ + ⅝ + ¾ + 1¼ + 1¼ + 2½ + 2½ + 5/16 + ½ days = 27 1/16 days' work.

(B)

1—Lathe, 24 in. x 14 ft.*

Turn valve yokes, new engines, 4 x 2 8
Repairs 30 x 2 x 50%..... 30

38 per month.

Av. time, 2 hours per yoke = 9½ days' work.
Turn piston valves, repairs, 30 x 2 x 10%..... 6 per month.
Average time, 10 hours = 7½ days' work.
Turn valve rods, new engines, 4 x 2 8
Repairs, 30 x 2 x 4%..... 2

10 per month.

Average time, 4 hours = 5 days' work.
Turn lifting shaft, new engines, 4 x 1 4
Repairs, 30 x 1 x 7%..... 2

6 per month.

Average time, 2½ hours = 1⅞ days' work.
Turn bearings on old lifting shaft, 30 x 1 x 50%..... 15 per month.
Average time, 40 min. = 1¼ days' work.
Total time, 9½ + 7½ + 5 + 1⅞ + 1¼ days = 25⅛ days' work.

(C)

1—Slotter, 12 in. 15-in. William Sellers Slotter.

Slot valve yokes, new engines, 4 x 2..... 8
Repairs, 30 x 2 x 10%..... 6

14 per month.

Average time, 2 hrs. per yoke = 3½ days' work.
Slot keyways in eccentric cams, new engines, 4 x 4..... 16
Repairs, 30 x 4 x 30%..... 36

52 per month.

Average time, 20 mins. = 2¼ days' work.
Slot keyway in eccentric crank cam, new engines, 4 x 2..... 8
Repairs, 30 x 2 x 4%..... 2

10 per month.

Average time, 15 mins. = 5/16 days' work.
Slot keyways in lift shaft cam, new engines, 4 x 1..... 4
Repairs, 30 x 1 x 7%..... 2

6 per month.

Average time, 15 mins. = 5/16 days' work.
Slot eccentric rod for brass bearing, new engines, 4 x 2..... 8
Repairs, 30 x 2 x 7%..... 2

10 per month.

Average time, 2 hrs. = 2½ days' work.
Slot clearance in radius bars, new engines, 4 x 2..... 8
Repairs, 30 x 2 x 7%..... 2

10 per month.

Average time, 1½ hrs. = 1⅞ days' work.
Slot transmission bars (Repairs), 30 x 2 x 10% ..... 6 per month.
Average time, 3 hrs. = 2¼ days' work.
Slot clearance in links, new engines, 4 x 2..... 8
Repairs, 30 x 2 x 5%..... 3

11 per month.

Average time, 2 hrs. = 2¾ days' work.
Reverse lever quadrant, new engines, 4 x 1..... 4
Repairs, 30 x 1 x 10% 3

7 per month.

Average time, 3 hrs. = 2⅝ days' work.
Slot transmission bar hangers.
Repairs, 30 x 2 x 16% ..... 10 per month.
Average time, 2 hrs. = 2½ days' work.

* Indicates old machines.

Total time, 3½ + 2¼ + 5/16 + 3/16 + 2½ + 1⅞ + 2¼ + 2¾ + 2⅝ + 2½ days = 20¾ days' work.

13. (A) *Valve Gear.*

1—Lathe, 32 in. x 12 ft.
30-in. x 12-ft. Lathe, Lodge & Shipley, Latest Improved Patent Head.

Turn rocker shafts, new engines, 4 x 2..... 8
Repairs, 30 x 2 x 10%..... 6

14 per month

Average time, 4 hrs. = 7 days' work.
Turn old rocker shafts.
Repairs, 30 x 2 x 50%.....30 per month.
Average time, 1 hr. 5¾ days.
Turn Walschaerts Link Saddles, new engines, 4 x 2..... 8
Repairs, 30 x 2 x 4%..... 2

10 per month.

Average time, 2 hrs. = 2½ days' work.
Bore and face bell yoke for bell, new engines, 4 x 1..... 4
Repairs, 30 x 1 x 25%..... 8

12 per month.

Average time, 1½ hrs. = 2¼ days' work.
Male center castings, new engines, 4 x 1..... 4
Repairs, 30 x 1 x 10%..... 3

7 per month.

Average time, 2 hrs. = 1¾ days.
Mud chambers for tanks, new engines, 4 x 2..... 8
Repairs, 30 x 2 x 10%..... 6

14 per month.

Average time, 2 hrs. = 3½ days' work.
Dry pipe sleeves, new engines, 4 x 2..... 8
Repairs, 30 x 2 x 4%..... 2

10 per month.

Average time, 2 hrs. = 2½ days' work.
Stand pipes, new engines, 4 x 1. 4
Repairs, 30 x 1 x 10%..... 3

7 per month.

Average time, 1 hr. = ⅞ day's work.
Old stand pipes trued.....
Repairs, 30 x 1 x 20%.....6 per month
Average time, 30 mins. = ⅜ day's work.
Exhaust pipes, new engines, 4 x 1 4
Repairs, 30 x 1 x 20%..... 6

10 per month.

Average time, 1½ hrs. = 1⅞ days' work.
Dome caps, new engines, 4 x 1 4
Repairs, 30 x 1 x 10%..... 3

7 per month.

Average time, 4 hrs. = 3½ days' work.
Total time, 7 + 3¾ + 2½ + 2¼ + 1¾ + 3½ + 2½ + ⅞ + ⅜ + 1⅞ + 3½ days = 29⅞ days' work.

(B)

1—18-in. x 10-ft. Lathe.*
1—20-in. x 10-ft. Lathe.*

Turn new pins and bushings for 34 locomotives = 550 pins per month.
Average time, 45 mins. per pin = 51½ hrs. = 51½ divided by 26 = 2 machines.

(C)

1—Turntable Connecting Machine, capacity 4 in.
2-in. Revolving Centering Machine, M. M. & M., capacity 4 in.

(D)

1—3-in. x 36-in. Turret Lathe.
3¼-in. x 36-in. Warner & Swasey Hollow Hexagon Turret Lathe.

Turn all motion pins, bushings, etc.

(E)

1—37-in. Rapid Production Vertical Lathe (Bullard).
37-in. Rapid Production Vertical Lathe (Bullard).

Bore eccentric straps, new engines, 4 x 4..... 16
Repairs, 30 x 4 x 50%..... 60

76 per month.

Average time, 1 hr. = 9½ days' work.
Rebore old eccentric straps....
Repairs, 30 x 4 x 20%.....24 per month.
Average time, 40 mins. = 2 days' work.
Bore eccentric cranks, new engines, 4 x 2..... 8
Repairs, 30 x 2 x 4%..... 2

10 per month.

Average time, 2 hrs. = 2½ days' work.
Piston valve cylinder heads....
Repairs, 30 x 4 x 5%.....6 per month.
Average time, 2 hrs. = 1½ days' work.
Hub plates, new engines, 4 x 8 32
Repairs, 30 x 8 x 10%..... 24

56 per month.

Average time, 1¼ hrs. = 10½ days' work.
Total time, 9½ + 2 + 2½ + 1½ + 10½ days = 26 days' work.

* Indicates old machines

(F)

1—Horizontal Boring Mill, 4-in. Spindle, 6-ft. Table.

Bore rocker boxes, new engines, 4 x 2..... 8
Repairs, 30 x 2 x 10%..... 6
14 per month.
Old boxes bored for bush, 30 x 2 x 10%..... 6
20 per month.
Average time, 2 hrs. = 5 days' work.
Bore bushed boxes, 30 x 2 x 60%. 36 per month.
Average time, 1¼ hrs. = 5⅝ days' work.
Bore valve guide crosshead, 4 x 2 8
Repairs, 30 x 2 x 7%..... 4
12 per month.
Average time, 40 mins. = 1 days' work.
Bore lift shaft boxes, new engines, 4 x 2..... 8
Repairs, 30 x 2 x 10%..... 6
14 per month.
Average time, 45 mins. = $1\frac{5}{16}$ days' work.
Bore transmission on bar hangers
Repairs, 30 x 2 x 16%.....10 per month.
Average time, 1 hr. = 1¼ days' work.
Bore link brackets (Walschaerts) new engines, 4 x 2..... 8
Repairs, 30 x 2 x 4%..... 2
10 per month.
Average time, 2½ hrs. = 3⅛ days' work.
Bore steam chests, new engines, 4 x 2..... 8
Repairs, 30 x 2 x 17%..... 10
18 per month.
Average time, 1 hr. = 2¼ days' work.
Bore and make joints on throttle box, new engines, 4 x 1..... 4
Repairs, 30 x 1 x 10%..... 3
7 per month.
Average time, 3 hours = 2⅝ days' work.
Rebore old throttle boxes, repairs, 30 x 1 x 20%..... 6 per month.
Average time, 1 hour = ¾ day's work.
Ream old crossheads for piston fit, repairs, 30 x 2 x 10%... 6 per month.
Average time, 1 hour = ¾ day's work.
Total, 5 + 5⅝ + 1 + $1\frac{5}{16}$ + 1¼ + 3⅛ + 2¼ + 2⅝ + ¾ + ¾ days = $23\frac{11}{16}$ days' work.

(G)

1—Planer, 30 in. x 10 ft. D. H.*

Plane eccentric cams, new engines, 4 x 4 16
Repairs, 30 x 4 x 30%..... 36
52 per month.
Average time, 1 hour = 6½ days' work.
Plane link bracket, new engines, 4 x 2 8
Repairs, 30 x 2 x 4%..... 2
10 per month.
Average time, 2 hours = 2½ days' work.
Plane link saddles (Walschaerts), Plane link saddles (Walschaerts), new engines, 4 x 4.. 16
Repairs, 30 x 4 x 4%..... 4
20 per month.
Average time, 3 hours = 7½ days' work.
Plane filling blocks, new engines, 4 x 4 16
Repairs, 30 x 4 x 5%..... 6
22 per month.
Average time, 2 hours = 5½ days' work.
Plane driver brake, fulcrum castings, new engines, 4 x 2.... 8
Repairs, 50 x 2 x 10%..... 6
14 per month.
Average time, 1 hour = 1¾ days' work.
Plane chafing blocks, new engines, 4 x 1..... 4
Repairs, 30 x 1 x 20%..... 6
10 per month.
Average time, 1¼ hours = 1½ days work.
Plane hopper castings, new engines, 4 x 1..... 4
Repairs, 30 x 1 x 20%..... 6
10 per month.
Average time, 40 min. = ⅞ day's work.
Total time, 6½ + 2½ + 7½ + 5½ + 1¾ + 1½ + ⅞ days = 26⅛ days' work.

(H)

1—Special Horizontal Milling Machine, 30 in. x 10 ft. Niles-Bement-Pond 30-in. x 10-ft. Side Head Slab Milling Machine.

Mill combination lever, new engines, 4 x 2..... 8
Repairs, 30 x 2 x 4%..... 2
10 per month.
Average time, 3 hours = 3¾ days' work.
Mill radius bar, new engines, 4 x 2 8
Repairs, 30 x 2 x 4%..... 2
10 per month.
Average time, 5 hours = 6¼ days' work.
Mill eccentric rods, new engines, 4 x 2 8
Repairs, 30 x 2 x 4%..... 2
10 per month.
Average time, 6 hours = 7½ days' work.
Mill guide bar (Walschaerts Gear), new engines, 4 x 2.... 8
Repairs, 30 x 2 x 4%..... 2
10 per month.
Average time, 2 hours = 2½ days' work.
Mill reverse lever, new engines, 4 x 1 4
Repairs, 30 x 1 x 10%..... 3
7 per month.
Average time, 1½ hours = $1\frac{5}{16}$ days' work.
Mill reverse lever quadrant, new engines, 4 x 1..... 4
Repairs, 30 x 1 x 10%..... 3
7 per month.
Average time, 1 hour = ⅞ day's work.
Total time, 3¾ + 6¼ + 7½ + 2½ + $1\frac{5}{16}$ + ⅞ days = 22¼ days' work.

(I)

Vertical Milling Machines—
1—42-in. Table, height of Spindle 25 in.
1—26-in. x 10¼-in. diam. Rotary Table, 17 in.
No. 10 Niles-Bement-Pond Vertical Milling Machine, dia. table 42 in.
No. 2 Vertical High Power Cincinnati Milling Machine with Circular Milling Attachment, diam. 16 in.

Mill links, new engines, 4 x 2.. 8
Repairs, 30 x 2 x 5%..... 3
11 per month.
Average time, 6 hours = 8¼ days' work.
Mill combination levers, new engines, 4 x 2..... 8
Repairs, 30 x 2 x 4%..... 2
10 per month.
Average time, 10 hours = 12½ days' work.
Mill radius bar, new engines, 4 x 2 8
Repairs, 30 x 2 x 4%..... 2
10 per month.
Average time, 12 hours = 15 days' work.
Mill eccentric rods, new engines, 4 x 2 8
Repairs, 30 x 2 x 4%..... 2
10 per month.
Average time, 1 hour = 1¼ days' work.
Mill union bars, new engines, 4 x 2 8
Repairs, 30 x 2 x 4%..... 2
10 per month.
Average time, 3 hours = 3¾ days' work.
Mill eccentric jaws, repairs, 30 x 4 x 10%..... 12 per month.
Average time, 2 hours = 3 days' work.
Mill rocker arms, repairs, 30 x 2 x 10%..... 6 per month.
Average time, 3½ hours = 2⅝ days' work.
Mill link blocks, new engines, 4 x 2 8
Repairs, 30 x 2 x 10%..... 6
14 per month.
Average time, 1 hour = 1¾ days' work.
Mill link hangers, new engines, 4 x 2 8
Repairs, 30 x 2 x 10%..... 6
14 per month.
Average time, 3 hours = 5¼ days' work.
Mill link saddles, new engines, 4 x 4 16
Repairs, 30 x 4 x 5%..... 6
22 per month.
Average time, 1½ hours = 4⅛ days' work.
Mill rod keys, new engines, 4 x 4. 16
Repairs, 30 x 4..... 18
34 per month.
Average time, 9 min. = ⅝ day's work.
Total time, 8¼ + 12½ + 15 + 1¼ + 3¾ + 3 + 2⅝ + 1¾ + 5¼ + 4⅛ + ⅝ days = 56⅛ days, divided by 26 = 2 machines.

(J)

1—Crank Planer, 20 in. x 20 in. x 24 in.
20-in x 20-in. x 24-in. Newton Crank Planer.

Plane eccentric straps for blade fit, 4 x 4..... 16
Repairs, 4 x 30 x 50%..... 60
76 per month.
Av. time, 25 min. per strap = 4 days' work.
Plane lift shaft boxes, new engines, 4 x 2..... 8
Repairs, 30 x 2 x 10%..... 6
14 per month.
Average time, 1 hour = 1¾ days' work.
Plane valve rod guide box (Walschaerts), new engines, 4 x 2.. 8
Repairs, 30 x 2 x 10%..... 6
14 per month.
Average time, 3 hours = 5¼ days' work.
Plane eccentric blades for strap fit, repairs, 30 x 4 x 10%....14 per month
Average time, 30 min. = ¾ day's work.

* Indicates old machines.

Plane link block plates, repairs, 30 x 2 x 10% ..... 6 per month.
Average time, 30 min. = 5/8 day's work.
Plane radius bar guide box, new engines, 4 x 2..... 8
Repairs, 30 x 2 x 4%..... 2
10 per month.
Average time, 2 hours = 2½ days' work.
Plane link block, new engines, 4 x 2 8
Repairs, 30 x 2 x 10%..... 6
14 per month.
Average time, 20 min. = 5/12 day's work.
Plane link block plates, repairs, 30 x 4 x 30%..... 36 per month.
Average time, 20 min. = 1½ days' work.
Plane cap for transmission bar hanger, repairs, 30 x 2 x 17% 10 per month.
Average time, 30 min. = 5/8 day's work.
Brake hanger brackets, new engines, 4 x 4 16
Repairs, 30 x 4 x 10%..... 12
28 per month.
Average time, 1 hour = 3½ days' work.
Total time, 4 + 1¾ + 5¼ + ¾ + ⅜ + 2½ + ⅝ + 1½ + ⅝ +3½ days = 20⅞ days' work.

(K)

1—3-ft. Radial Drill.* 3-ft. Western Radial Drill. 1—26-in. Vertical Drill.

Drill lift shaft arms, new engines, 4 x 1..... 4
Repairs, 30 x 1 x 7%..... 2
6 per month.
Average time, 1 hour = ¾ day's work.
Drill rocker arms, repairs, 30 x 2 x 10%..... 6 per month.
Average time, 3 hours = 2¼ days' work.
Drill valve guide crosshead and cap, new engines, 4 x 2..... 8
Repairs, 30 x 2 x 4%..... 2
10 per month.
Average time 1½ hours = 1⅞ days' work.
Drill link saddles, new engines (Walschaerts), 4 x 4..... 16
Repairs, 30 x 4 x 5%..... 6
22 per month.
Average time, 15 min. = 5/8 day's work.
Drill union bar (Walschaerts) new engines, 4 x 2..... 8
Repairs, 30 x 2 x 4% 2
10 per month.
Average time, 1 hr. = 1¼ days' work.
Drill union bar bracket, new engines, 4 x 2..... 8
Repairs, 30 x 2 x 4% 2
10 per month.
Average time, 30 mins. = 5/8-day's work.
Drill combination lever, new engines, 4 x 2 8
Repairs, 30 x 2 x 4% 2
10 per month.
Average time, 1½ hrs. = 1⅞ days' work.
Drill radius bar, new engines, 4 x 2 8
Repairs, 30 x 2 x 4% 2
10 per month.
Average time, 2 hrs. = 2½ days' work.
Drill eccentric rods, new engines, 4 x 2 8
Repairs, 30 x 2 x 4% 2
10 per month.
Average time, 1½ hrs. = 1⅞ days' work.
Drill guide bar (Walschaerts), new engines, 4 x 2 8
Repairs, 30 x 2 x 4% 2
10 per month.
Average time, 45 mins. = 15/16-day's work.
Drill reverse lever, new engines, 4 x 1..... 4
Repairs, 30 x 1 x 10%..... 3
7 per month.
Average time, 35 mins. = ½-day's work.
Drill reverse lever quadrant, new engines, 4 x 1..... 4
Repairs, 30 x 1 x 10% 3
7 per month.
Average time, 15 mins. = 3/16-day's work.
Drill eccentric jaws, repairs, 30 x 4 x 10% .....12 per month.
Average time, 33 mins. = ⅞-day's work.
Drill link blocks, new engines, 4 x 2 8
Repairs, 30 x 2 x 10%..... 6
14 per month.
Average time, 1 hr. = 1⅞ days' work.
Drill throttle latch, new engines, 4 x 1. 4
Repairs, 30 x 1 x 20%..... 6
10 per month.
Average time, 3 mins. = 1/16-day's work.

* Indicates old machines.

Drill throttle latch handle, new engines, 4 x 1 4
Repairs, 30 x 1 x 20%..... 6
10 per month.
Average time, 6 mins. = 1/8-day's work.
Drill reverse lever latch handle, new engines, 4 x 1..... 4
Repairs, 30 x 1 x 20%..... 6
10 per month.
Average time, 6 mins. = 1/8-day's work.
Drill reverse lever latch, new engines, 4 x 1 4
Repairs, 30 x 1 x 10%..... 3
7 per month.
Average time, 15 mins. = 3/16-day's work.
Drill throttle lever quadrant, new engines, 4 x 1 4
Repairs, 30 x 1 x 10%..... 3
7 per month.
Average time, 10 mins. = 1/8-day's work.
Drill radius bar guide box, new engines, 4 x 1..... 4
Repairs, 30 x 1 x 10%..... 3
7 per month.
Average time, 45 mins. = 5/8-day's work.
Drill link block plates, repairs, 30 x 4 x 30%..... 36 per month.
Average time, 12 mins. = 7/8-day's work.
Drill link hangers, new engines, 4 x 2..... 8
Repairs, 30 x 2 x 10%..... 6
14 per month.
Beach rod drilled, new engines, 4 x 1 4
Repairs, 30 x 1 x 7% 2
6 per month.
Average time, 40 mins. = ½-day's time.
Drill eccentric straps, repairs, 30 x 4 x 63%..... 76 per month.
Average time, 2 hrs. = 19 days' work.
Drill valve rods, new engines, 4 x 2 8
Repairs, 30 x 2 x 4% 2
10 per month.
Average time, 20 mins. = ⅜-day's work.
Drill and tap piston heads, new engines, 4 x 2 8
Repairs, 30 x 2..... 60
68 per month.
Average time, 1 hr. = 8½ days' work.
Drill piston rod gland, new engines, 4 x 2..... 8
Repairs, 30 x 2 x 15%..... 9
17 per month.
Average time, 20 mins. = ¾-day's work.
Drill valve stem gland, new engines, 4 x 2 8
Repairs, 30 x 2 x 15%..... 9
17 per month.
Average time, 15 mins. = ½-day's work.
Total time, ¾ + 2¼ + 1⅞ + ⅝ + 1¼ + ⅝ + 1⅞ + 2½ + 1⅞ + ½ + 3/16 + ⅞ + 1⅞ + 1/16 + ⅛ + ⅛ + 3/16 + ½ + ⅝ + ⅞ + 2 + ½ + 19 + ⅜ + 8½ + ¾ + ½ days = 50¾ days' work ÷ 26 = 2 machines.

14 (A) *Pistons.*

1—37-in. Vertical Rapid Production Lathe (Bullard). 37-in. Vertical Rapid Production Lathe (Bullard).

Bore and turn piston head, new engines, 4 x 2..... 8
Repairs, 30 x 2 60
68 per month.
Average time, 3 hrs. = 25½ days' work.

15 (A) *Engine and Tender Truck Work.*

1—Car Wheel Boring Mill, 48-in. (Putman) Facing Attachments. William Sellers 54-in. Car Wheel Boring Mill.

Bore wheels, new engines, 4 x 10 40
Repairs, 30 x 11 x 60%.....198
238 per month.
Average time, 20 mins. = 10 days' work.

(B)

1—Steel-Tired Wheel Lathe, 48 in. (Niles-Bement-Pond latest). 42-in. William Sellers Extra High Power Steel-Tired W. Lathe.

Turn tires, repairs, 30 x 5....150 prs. pr. mo.
Average time, 1 hr. per pair = 18¾ days' work.

(C)

1—Planer, 36 in. x 10 ft. (4 heads). 36-in. x 36-in. x 10-ft. William Sellers Single Belt Pneumatic Clutch Planer, 4 heads.

Plane truck center castings, new engines, 4 x 1..... 4
Repairs, 30 x 1 x 10%..... 3
7 per month.
Average time, 2 hrs. = 1¾ days' work.
Plane guide yoke extensions, new engines, 4 x 2..... 8
Repairs, 30 x 2 x 7%..... 4
12 per month.
Average time, 4 hrs. = 6 days' work.

Plane pedestals, new engines, 4 x 4 13
Repairs, 30 x 6 x 10% 18
34 per month.
Average time, 30 mins. = 2⅛ days' work.
Plane binder castings for tender truck, new engines, 4 x 4 .. 16
Repairs, 30 x 4 x 10% 12
28 per month.
Average time, 45 mins. = 2⅝ days' work.
Plane rocker box for frame fit, new engines, 4 x 2 8
Repairs, 30 x 2 x 10% 6
14 per month.
Average time, 1 hr. = 1¾ days' work.
Plane expansion brace, new engines, 4 x 1 4
Repairs, 30 x 1 x 7% 2
6 per month.
Average time, 12 hrs. = 9 days' work.
Center castings, equalizer fulcrums, tender center castings, new engines, 4 x 4 16
Repairs, 30 x 4 x 5% 6
22 per month.
Average time, 2½ hrs. = 6⅞ days' work.
Total time, 1¾ + 6 + 2⅛ + 2⅝ + 1¾ + 9 + 6⅞ days = 30⅛ days' work.

(D)

1—4-ft. Radial Drill.
4-ft. Western Triple-Geared Radial Drill.

Drill engine trucks, new engines. 4 x 1 4
Repairs, 30 x 1 x 10% 3
7 per month.
Average time, 13 hrs. = 11⅝ days' work.
Drill tender trucks, new engines, 4 x 1 4
Repairs, 30 x 1 x 10% 3
7 per month.
Average time, 16 hrs. = 14 days' work.
Total time, 11⅜ + 14 days = 25⅜ days' work.

(E) *For Tender Wheels*

1—Wheel Press, 200 tons.*

16 (A) *Shoes and Wedges.*

1—36-in. x 12-ft. Planer.
36-in. x 36-in. x 12-ft. Niles-Bement-Pond Planer, 2 heads on cross-rail.

Plane for frame fit, new engines, 4 x 16 64
Repairs, 30 x 16 x 75% 360
424 per month.
Average time, 35 mins. = 31 days' work.

(B)

1—20-in. x 20-in. x 24-in. Crank Planer.
20-in. x 20-in. x 24-in. Newton Crank Planer.

Plane shoes and wedges to line, new engines, 4 x 16 64
Repairs, 30 x 16 480
544 per month.
Average time, 20 mins. = 22⅝ days' work.

17 (A) *Throttle Rigging.*

1—3-ft. Radial Drill.*

Drill dry pipe and sleeve, new engines, 4 x 1 4
Repairs, 30 x 1 x 10% 3
7 per month.
Average time, 40 mins. = ⅝ day's work.
Drill stand pipe U-bolt and tap, new engines, 4 x 1 4
Repairs, 30 x 1 x 10% 3
7 per month.
Average time, 20 mins. = 5/16 day's work.
Drill stand pipe brace, new engines, 4 x 1 4
Repairs, 30 x 1 x 10% 3
7 per month.
Average time, 15 mins. = ¼ day's work.
Drill throttle stuffing box and gland, new engines, 4 x 1 4
Repairs, 30 x 1 x 10% 3
7 per month.
Average time, 20 mins. = 5/16 day's work.
Drill levers, cranks, shaft arms, quadrants, quadrant brackets, latch lifter and reach rods, new engines, 4 x 1 4
Repairs, 30 x 1 x 10% 3
7 per month.
Av. time, 2⅝ hrs. per set = 2⅛ days' work.
Drill dome caps, new engines, 4 x 1 4
Repairs, 30 x 1 x 10% 3
7 per month.
Average time, 1 hour = ⅞ day's work.
Drill auxiliary domes, new engines, 4 x 1 4
Repairs, 30 x 1 x 10% 3
7 per month.
Average time, 1 hour = ⅞ day's work.

* Indicates old machines.

Drill tee heads, new engines, 4 x 1 4
Repairs, 30 x 1 x 10% 3
7 per month.
Average time, 1¼ hours = 1⅛ day's work.
Drill steam pipes, new engines, 4 x 2 8
Repairs, 30 x 2 x 10% 6
14 per month.
Average time, 2 hours = 3½ days' work.
Drill exhaust pipes, new engines, 4 x 1 4
Repairs, 30 x 1 x 10% 3
7 per month.
Average time, 1 hour = ⅞ day's work.
Drill exhaust pipe shield, new engines, 4 x 1 4
Repairs, 30 x 1 x 10% 3
7 per month.
Average time, 10 mins. = ⅛ day's work.
Drill draw castings, new engines, 4 x 1 4
Repairs, 30 x 1 x 30% 9
13 per month.
Average time, 1 hour = 1⅝ days' work.
Drill pilot bottom frames, new engines, 4 x 1 4
Repairs, 30 x 1 x 20% 6
10 per month.
Average time, 1 hour = 1¼ days' work.
Drill top rails for pilot, new engines, 4 x 1 4
Repairs, 30 x 1 x 20% 6
10 per month.
Average time, 1 hour = 1¼ day's work.
Drill main brace for pilots, new engines, 4 x 1 4
Repairs, 30 x 1 x 20% 6
10 per month.
Average time, 30 mins. = ⅝ day's work.
Drill corner uprights for pilot, new engines, 4 x 2 8
Repairs, 30 x 2 x 20% 12
20 per month.
Average time, 15 mins. = ⅝ day's work.
Drill smoke arch braces, new engines, 4 x 2 8
Repairs, 30 x 2 x 20% 12
20 per month.
Average time, 30 mins. = 1¼ days' work.
Drill bunter beam casting, new engines, 4 x 2 8
Repairs, 30 x 2 x 20% 12
20 per month.
Average time 2 hours = 5 days' work.
Drill spring rigging, new engines, 4 x 1 4
Repairs, 30 x 1 x 20% 6
10 per month.
Average time, 9 hours = 11¼ days' work.
Total time, ⅝ + 5/16 + ¼ + 5/16 + 2⅛ + ⅞ + ⅞ + 1⅛ + 3½ + ⅞ + ⅛ + 1⅝ + 1¼ + 1¼ + ⅝ + ⅝ + 1¼ + ⅝ + 5 + 11¼ days = 33⅞ days' work.

18 (A) *Brake Rigging.*

1—3-ft. Radial Drill.*

Drilling brake rigging includes hangers, brackets and stands, etc.
Brake rigging, new engines, 4 x 1 4 set.
Repairs, 30 x 1 x 20% 6
10 set per mo.
Average time, 24 hours = 30 days' work.

19 (A) *Brass Work.*

1—Lathe, 16 in. x 6 ft.
16-in. x 6-ft. Lodge & Shipley Latest Improved Patent Head Lathe.

Piston and valve stem packing cones, glands and rings, new engines, 4 x 4 16
Repairs, 30 x 4 x 100% 120
136 per month.
Av. time, 1½ hrs. per set = 25½ days' work.

(B)

1—Lathe, 14 in. x 6 ft.*
14-in. x 6-ft. Lodge & Shipley Latest Improved Patent Head Lathe.

Tank valves, new engines, 4 x 2. 8
Repairs, 30 x 2 x 10% 6
14 per month.
Average time, 40 mins. = 1⅛ days' work.
Throttle stuffing box and gland, new engines, 4 x 1 4
Repairs, 30 x 1 x 10% 3
7 per month.
Average time, 2 hours = 1¾ days' work.
Rocker box bushings, repairs, 30 x 4 x 75% ..... 90 per month.
Average time, 20 mins. = 3¾ days' work.
Whistles, new engines, 4 x 1 ... 4
Repairs, 30 x 1 x 10% 3
7 per month.

* Indicates old machines.

Average time, 4 hours = 3½ days' work.
Tank hose nuts and connections, new engines, 4 x 2..... 8
Repairs, 30 x 2 x 20%..... 12

20 per month.

Average time, 20 mins. = ⅞ day's work.
Muffler safety valves overhauled, Repairs, 30 x 2 x 10%..... 60 per month
Average time, 1 hour = 7½ days' work.
Feed pipe sleeves, new engines, 4 x 2 8
Repairs, 30 x 2 x 20%..... 12

20 per month.

Average time, 17 mins. = ¾ day's work.
Driving box plugs, new engines, 4 x 8 ..... 32 boxes.
Repairs, 30 x 8 x 75%.....180

212 bxs. pr. m.

Av. time, 7 mins. per box = 3 days' work.
Stems for angle valves, etc....3¾ days' work.
Total time, 1⅛ + 1¾ + 3¾ + 3½ + ⅞ + 7½ + ¾ + 3 + 3¾ days = 26 days' work.

(C)

Turret Lathes—
2—18½ in. x 6 ft.
1—20 in. x 6 ft. 6 in.
1—18½ in. x 6 ft.
18-in. x 6-ft. American Tool & Machine. Latest Improved Geared Friction Head Brass Turret Lathe.

Injector steam valves (2-in. angles), new engines, 4 x 2.... 8
Repairs, 30 x 2 x 20%..... 12

20 per month.

Average time, 2¼ hours = 5⅝ days' work.
Old valves overhauled, 30 x 2 x 80% ..... 48 per month.
Average time, 30 mins. = 3 days' work.
Car heater valves, repairs, 30 x 1 x 25% ..... 7 per month.
Average time, 25 mins. = ⅝ day's work.
Lubricator valve, new engines, ¾ angle, 4 x 2..... 8
Repairs, 30 x 2 x 20%..... 12

20 per month.

Av. time, 1½ hrs. per valve = 3¾ days' work.
Old lubricator valves overhauled, repairs, 30 x 2 x 80%..... 48 per month.
Average time, 20 mins. = 2 days' work.
Steam and air gage cocks, new engines, 4 x 4..... 16
Repairs, 30 x 4 x 20%..... 24

40 per month.

Average time, 25 mins. = 2⅛ days' work.
Old steam and air gage cocks overhauled, repairs, 30 x 4 x 80% ..... 96 per month.
Average time, 10 mins. = 2 days' work.
Tallow plugs, new engines, 4 x 2. 8
Repairs, 30 x 2 x 20%..... 12

20 per month.

Average time, 35 mins. = 1½ days' work.
Tallow plugs overhauled, repairs 30 x 2 x 80%.....48 per month.
Average time, 15 mins. = 1½ days' work.
Check valve, new engines, 4 x 2 8
Repairs, 30 x 2 x 2%..... 12

20 per month.

Average time, 2½ hrs. = 6½ days' work.
Old check valves overhauled, repairs, 30 x 2 x 80% = 48 per month.
Average time, 25 mins. = 2½ days' work.
Relief valves, new engines, 4 x 2. 8
Repairs, 30 x 2 x 20%..... 12

20 per month.

Average time, 2 hrs. = 5 days' work.
Old relief valves, overhauled, repairs, 30 x 2 x 80%.....48 per month.
Average time, 20 mins. = 2 days' work.
Blow-off cocks, new engines, 4 x 1..... 4
Repairs, 30 x 1 x 20%..... 6

10 per month.

Average time, 2½ hrs. = 3⅛ days' work.
Old blow-off cocks overhauled, repairs, 30 x 1 x 80%.....24 per month
Average time, 30 mins. = 1½ days' work.
Water glass cocks, new engines, 4 x 2..... 8
Repairs, 30 x 2 x 20%..... 12

20 per month.

Average time, 1⅞ hrs. = 4¼ days' work.
Old water glass cocks overhauled, repairs, 30 x 2 x 80%..... 48 per month.
Average time, 20 mins. = 2 days' work.
Gage cocks, new engines, 4 x 6 24
Repairs, 30 x 6 x 20%..... 36

60 per month.

Average time, 50 mins. = 6¼ days' work.
Old gage cocks overhauled, repairs, 30 x 6 x 80%.....144 per month.
Average time, 8 mins. = 2⅔ days' work.
Air pump valve (1 in. angle) new engines, 4 x 1..... 4
Repairs, 30 x 1 x 20%..... 6

10 per month.

Average time, 1 7/12 hours = 2 days' work.
Overhaul old air pump valves, repairs, 30 x 1 x 80%.....24 per month.
Average time, 25 mins. = 1¼ days' work.
Blower valve, new engines, 4 x 2 8
Repairs, 30 x 2 x 20%..... 12

20 per month.

Average time, 1 7/12 hrs. = 4 days' work.
Old blower valves overhauled, repairs, 30 x 2 x 80%.....48 per month.
Average time, 25 mins. = 2½ days' work.
Cylinder cocks, new engines, 4 x 4 16
Repairs, 30 x 4 x 20%..... 24

40 per month.

Average time, 1 hr. = 5 days' work.
Old cylinder cocks overhauled, repairs, 30 x 4 x 80%.....96 per month.
Average time, 8 mins. = 1⅔ days' work.
Pet cocks, ⅜ in. new engines, 4 x 8..... 32
Repairs, 30 x 8 x 20%..... 48

80 per month.

Average time, 30 mins. = 3 days' work.
Pet cocks overhauled, repairs, 30 x 8 x 80%.....192 per month.
Average time, 6 mins. = 2⅜ days' work.
Blower connections, new engines, 4 x 2..... 8
Repairs, 30 x 2 x 20%..... 12

20 per month.

Average time, 18 mins. = ¾ day's work.
Tallow pipe connections and nuts, 4 x 2..... 8
Repairs, 30 x 2 x 20%..... 12

20 per month.

Average time, 18 mins. = ¾ day's work.
Tank cocks, new engines, 4 x 1 4
Repairs, 30 x 1 x 20%..... 6

10 per month.

Average time, 1 1-6 hrs. = 1½ day's work.
Old tank cocks overhauled, repairs, 30 x 1 x 80%.....24 per month.
Average time, 20 mins. = 1 day's work.
Whistle elbows or sleeve, new engines, 4 x 1..... 4
Repairs, 30 x 1 x 10%..... 3

7 per month.

Average time, 18 mins. = ¼ day's work.
Cab door lock and slides, new engines, 4 x 2..... 8
Repairs, 30 x 2 x 10%..... 6

14 per month.

Average time, 30 mins. = ⅞ day's work.
Brazing rings (say 500 per month) .....1 day's work.
Extension for water and gage cocks, new engines, 8 x 8.... 64
Repairs, 30 x 8 x 10%..... 24

88 per month.

Average time, 12 mins. = 2½ days' work.
Pipe sleeves and nuts, 34 x 8 x 20%.....55 per month.
Average time, 17 mins. = 2 days' work.
Filling plugs and nuts for lubricator repairs..... 30 per month.
Average time, 15 mins. = 1 day's work.
Drain plugs for lubricator repairs .....30 per month.
Average time, 4 mins. = ¼ day's work.
Sand nozzles, 50 per month.
Average time, 3 mins. = ⅛ day's work.
Extension sleeves for safety valves, new engines, 4 x 2.... 8
Repairs, 30 x 2 x 10%..... 6

14 per month.

Average time, 20 mins. = ⅝ day's work.
Nipples and reducers, 200 per month.
Average time, 10 mins. = 4 days' work.
Rocker box set bolts, repairs, 30 x 4 x 20%.....24 per month
Average time, 4 mins. = 1/8 day's work.
Boiler plugs, new engines, 4 x 10 40
Repairs, 30 x 10 x 10%..... 30

70 per month.

Average time, 4 mins. = ⅝ day's work.
Rub liner bolts, new engines, 4 x 64 256
Repairs, 30 x 64 x 10%.....192

448 per month.

Average time, 4 mins. = 3⅜ day's work.
Total time, 5⅝ + 3 + ⅜ + 3¾ + 2 + 2⅛ + 2 + 1½ + 1½ + 6¼ + 2½ + 5 + 2 + 3⅛ + 1½ + 4¼ + 2 + 6¼ + 2⅜ + 2 + 1¼ + 4 + 2½ + 5 + 1⅝ + 5 + 2⅜ + ¾ + ¾ + 1½ + 1 + ¼ + ⅞ + 1 + 2¼ + 2 + 1 + ¼ + ½ + ⅝ + 4 + 1/16 + ⅝ + 3¾ days = 102½ days' divided by 26 = 4 machines.

1—B. B. Vertical Milling Machine.
No. 4 Vertical High Power Cincinnati Milling Machine.

(D) *Rod Brasses.*
Mill rod brasses for strap fit, new engines, 4 x 4..... 16
Repairs, 30 x 4.....120

136 per month.

Average time, 1½ hrs. = 25½ days' work.

1—37-in. Vertical Rapid Production Lathe (Bullard), 4 jaws.
37-in. Vertical Rapid Production Lathe (Bullard), 4 jaws.

(E)
Bore and face rod brasses, new engines, 4 x 4 16
Repairs, 30 x 4 120
136 per month.
Average time, 40 mins. = 11⅓ days' work.
Bore and turn rod bushings, new engines, 4 x 8 32
Repairs, 30 x 8 240
272 per month.
Average time, 25 mins. = 14⅙ days.
Total 11⅓ + 14⅙ days = 25½ days' work.

1—Lathe, 16 in. x 6 ft.
16-in. x 16-in. Lodge & Shipley Latest Improved Patent Head Lathe.

(A) *Air Brake Work.*
Air Pump piston rod repairs, 30 x 25% ..... 8 per month.
Average time, 2½ hrs. = 2½ days' work.
Old piston rods and heads filed and regrooved, 30 x 75% .... 22 per month.
Average time, 40 mins. = 1⅞ days' work.
Refitting brake hanger posts, repairs, 30 x 6 x 70% ..... 126 per month.
Average time, 15 mins. = 4 days' work.
Brake fulcrum shaft, new engines, 4 x 2 8
Repairs, 20 x 2 x 10% 6
14 per month.
Average time, 1½ hrs. = 2⅝ days' work.
Total time, 2½ + 1⅞ + 4 + 2⅝ days = 11 days' work.

1—37-in. Vertical Rapid Production Lathe (Bullard).
37-in. Vertical Rapid Production Lathe (Bullard).

(B)
Bore and turn air pump piston head, repairs, 30 x 2 x 30% .... 18 per month.
Average time, 1 hr. = 2¼ days.
Air pump packing rings, repairs, 30 x 4 x 100% ..... 120 per month.
Average time, 8 mins. = 2 days' work.
Piston valve packing rings, repairs, 30 x 8 x 25% ..... 60 per month.
Average time, 40 mins. = 5 days' work.
Bore piston glands, new engines, 4 x 2 8
Repairs, 30 x 2 x 20% 12
20 per month.
Average time, 45 mins. = 1⅞ days' work.
Bore U. S. packing cases, new engines, 4 x 2 8
Repairs, 30 x 2 x 20% 12
20 per month.
Average time, 20 mins. = ⅞-day's work.
Rebore air pump cylinders, repairs, 30 x 2 x 50% ..... 30 per month.
Average time, 1 hr. = 3¾ days' work.
Total time, 2¼ + 2 + 5 + 1⅞ + ⅞ + 3¾ days = 15¾ days' work.

1—Planer, 48 in. x 12 ft.
48-in. x 28-in. x 12-ft. William Sellers Single Belt Pneumatic Planer; 2 heads on cross-rail, 1 side head.

21 (A) *Miscellaneous Castings.*
Guide yokes, new engines, 4 x 1 .. 4
Repairs, 30 x 1 x 7% 2
6 per month.
Average time, 7 hrs. = 5¼ days' work.
Plane truck cradle brace, new engines, 4 x 1 4
Repairs, 30 x 1 x 10% 3
7 per month.
Average time, 3 hrs. = 2⅝ days' work.
Plane truck frames, new engines, 4 x 1 4
Repairs, 30 x 1 x 10% 3
7 per month.
Average time, 2½ hrs. = 2¼ days' work.
Drawhead castings, engine and tender, front and back, new engines, 4 x 3 12
Repairs, 30 x 3 x 7% 6
18 per month.
Average time, 6⅔ hrs. = 15 days' work.
Crosstie, link bracket and lift-shaft tie brace, new engine, 4 x 1 4
Repairs, 30 x 1 x 4% 1
5 per month.
Average time, 15 hrs. = 9⅜ days' work.
Total time, 5¼ + 2⅝ + 2¼ + 15 + 9⅜ = 34¼ days' work.

1—32-in. Vertical Drill.*
1—5-ft. Radial Drill.
6-ft. Niles-Bement-Pond Radial Drill.

(B)
Drill center castings, engine and tender, fulcrum castings, expansion braces, filling blocks, driver brake fulcrum, hopper castings, drawhead castings, chafing blocks, crosstie brace, mud chambers, tank valve racks, guide yokes, guide yoke brackets and extensions, sand boxes, dome rings, smoke-box rings, fire-door frames and doors, bell yokes and frames, handhole plates and covers.
Total of 4,400 holes for new and repair work.

1—Slotter, 18 in.
18-in. T. C. Drill Slotter.

22 (A) *Miscellaneous Forgings.*
Frame braces, new engines, 4 x 3 12
Repairs, 30 x 3 x 10% 9
21 per month.
Average time, 3 hrs. = 7⅞ days' work.
Main equalizer, new engines, 4x1 4
Repairs, 30 x 1 x 10% 3
7 per month.
Average time, 5 hrs. = 4⅜ days' work.

* Indicates old machines.

Pedestal binders, repairs, 30 x 8 x 20% ..... 48 per month.
Average time, 1 hr. = 6 days' work.
Bearing bars, new engines, 4 x 2. 8
Repairs, 30 x 2 x 20% 12
20 per month.
Average time, 2 hrs. = 5 days' work.
Total time, 7⅞ + 4⅜ + 6 + 5 days = 23¼ days' work.

1—Planer, 36 in. x 10 ft.
36-in. x 36-in. x 10-ft. William Sellers Single Belt Pneumatic Clutch Planer: 2 heads on cross-rail, 1 side head.

(B)
Plane pedestal binder, new engines, 4 x 8 32
Repairs, 30 x 8 x 10% 24
56 per month.
Average time, 1⅓ hrs. = 9⅜ days' work.
Plane frame brace, new engines, 4 x 4 16
Repairs, 30 x 4 x 10% 12
28 per month.
Average time, 2 hrs. = 7 days' work.
Total time, 9⅜ + 7 = 16⅜ days' work.

1—4-ft. Radial Drill.*

(C)
Drill-frame braces, equalizers, binders, bearbars and supports, crank-pin collars, cab braces, foot-board brackets, etc.
Average, 2,000 holes = 26 days' work.

1—Lassiter, 6-spindle Threading Machine.*

23 (A) *Staybolts.*
Staybolts, new engines, 4x1500 6,000
Repairs, 30 x 1500 x 30% 13,500
19,500 per month.
19,500 bolts average = 7½ in. long.
1,880 bolts per day = 18 days' work.

1—4-spindle Drill.*

(B)
Drill tell-tale holes in 19,500 staybolts.
800 bolts per day = 24⅜ days' work.

1—6-in. Gisholt Machine.
1—4-in. Gisholt Machine 4-jaw chuck.
28-in. Niles-Bement-Pond Rigid Turret Lathe, with 6¼-in. hole through spindle.

24 (A) *Pin Work.*
Crank pins, front, back or inter pins, new engines, 4 x 6 24
Repairs, 30 x 6 x 50% 90
114 per month.
Average time, 45 mins. = 10¾ days' work.
Wrist pins, new engines, 4 x 2 .. 8
Repairs, 30 x 2 60
68 per month.
Average time, 45 mins. = 6⅜ days' work.
Knuckle pins, new engines, 4 x 4. 16
Repairs, 30 x 4 120
136 per month.
Average time, 20 mins. = 5⅝ days' work.
Brake-hanger posts, new engines, 4 x 6 24
Repairs, 30 x 6 x 50% 90
114 per month.
Average time, 35 mins. = 8⅜ days' work.
Miscellaneous pins and bushings, etc., 21 days' work.
Total time, 10¾ + 6⅜ + 5⅝ + 8⅜ + 21 days = 52 days' work.

Turret Lathes*
1—New 3 in. x 36 in.
1—New 2½. in. x 24 in.
3—2 in. x 24 in. Gridley 3¼-in. Automatic Turret Lathe.

25 (A)
Studs, new engines, 4 x 600 2,400
Repairs, 30 x 600 x 50% 9,000
11,400 per month.
Average, 175 per day = 65 days' work.
Set screws and pins, new engines,
Repairs, 30 x 80 2,400
4 x 80 320
2,720 per month.
Average length, 7 in. 60 pins per day = 45 days' work.
Core plugs for piston heads, new engines 32
Repairs, 30 x 8 240
272 per month.
Average, 125 per day = 2⅛ days' work.
Wedge adjusting screws, 4 x 8 ... 32
Repairs, 30 x 8 240
272 per month.
Average, 40 per day = 6⅘ days' work.
Driver brake adjusting screws, new engines, 4 x 2 8
Repairs, 30 x 2 60
68 per month.
Average, 16 per day = 4¼ days' work.
Total time, 65 + 45 + 2⅛ + 6⅘ + 4¼ days = 123 days' work, divided by 26 = 4⁹⁹/₂₆ machines.

1—4-head Lassiter Bolt Turning Machine.*

26 (A) *Bolts.*
Bolts, new engines, 4 x 474 ... 1,896
Repairs, 30 x 474 x 30% 4,266
6,162 per month.
Average, 300 bolts per day = 20½ days' work.

1—2-in. Centering Machine.
6-in. Pratt & Whitney, 2-spindle Centering Machine.

(B)

1—2-in. Bolt Pointer.
2-in. Acme Bolt Pointer.

(C)

* Indicates old machines.

2—Lathes, 12 in. x 5 ft.* For fitting bolts in machine shops.

3—Portable Lathes, 12 in. x 5 ft. For fitting bolts in erecting shop.

Acme Double Head Bolt Cutter, capacity ½ in. to 2 in. One (1) double-head threading machine, capacity, ⅜-in. to 2 in.

One (1) nut tapper (6-spindle).*

Victor 2-in. Nut Facing Machine, capacity ½ in. to 2 in. One (1) 2 in. nut facing machine.

P. D. Q. No. 2 Improved Pipe Threading and Cutting Off Machine, capacity ¼ in. to 2 in. One (1) machine for pipe nipples, ¼-in. to 2 in.

One (1) 6-in. pipe machine.*

Prentice Bros. 16-in., High Speed. Sensitive Drilling capacity ¾ in. The (2) 13-in. friction drills, capacity, ¾-in.

Four (4) tool grinders.*

Tool Room.

1 B. & S. No. 4 or similar universal milling machine. Milwaukee No. 3-B, Universal Tool Room Milling Machine.
1 Plain milling machine, 14 in. x 6 ft. Milwaukee No. 3-B Plain Milling Machine.
3 Lathes, two (2) 14 in. x 6 ft., one (1) 12 in. x 6 ft. Hendy-Morton Gear Head Tool Room Lathe.
1 Drill press, 24 in., heavy duty compound table. Niles-Bement-Pond 24-in. Vertical Drilling Machines.
1 13-in. frictional drill. Prentice Bros. 16-in. High Speed Sensitive Drilling Machine.
1 16-in. shaper. 16-in. Mark Flather Back Geared Crank Shaper.
1 Crank planer, 24½-in. stroke. 20 in. x 20 in. x 24 in. Newton Crank Planer.
1 Gisholt tool grinder.*
1 William Sellers tool grinder. Blunt Wet Tool Grinder, 20 in. x 2½ in.
1 Reamer grinder. Morse No. 2 Plain Grinder.
1 Cutter grinder. Improved No. 2 Walker Tool Room Grinder.
1 Die grinder. National Die Sharpener.
2 Twist drill grinders. American Twist Drill Grinder, Style W. T. A. F.

BOILER SHOP.

30 General repairs.
8 Light repairs.
4 New locomotives
Per month of 8 hours.

Shearing and Punching.

1—60-in. Throat Shear.*
1—36-in. Throat Shear.*

Shear and punch flue sheets, new, 4 x 2..... 8
Repairs, 30 x 2 x 20%..... 12
20 per month.

Time, 1 hour = 2½ days' work.
Shear and punch door sheet (firebox), 4 x 1..... 4
Repairs, 30 x 1 x 25%..... 7
11 per month.

Time, 3 hours = 4⅛ days' work.
Shear and punch door sheet (back head), 4 x 1..... 4
Repairs, 30 x 1 x 10%..... 3
7 per month.

Time, 3½ hours = 3 days' work.
Shear and punch throat sheet (firebox), 4 x 1..... 4
Repairs, 30 x 1 x 25%..... 7
11 per month.

Time, 3½ hours = 4¾ days' work.
Shear and punch throat sheet of boiler, 4 x 1 4
Repairs, 30 x 1 x 4% 1
5 per month.

Time, 4 hours = 2⅙ days' work.
Shear crown sheet of boiler, 4x1 4
Repairs, 30 x 1 x 4%..... 1
5 per month.

Time, 45 min. = 3¾ days' work.
Shear crown sheet, firebox, 4 x 1. 4
Repairs, 30 x 1 x 25%..... 7
11 per month.

Time, 45 min. = 1 day's work.
Shear side sheets of firebox, 4 x 2 8
Repairs, 30 x 2 x 27%..... 16
24 per month.

Time, 1 hour = 3 days' work.
Shear side sheets of boiler, 4 x 2 8
Repairs, 30 x 2 x 4%..... 2
10 per month.

Time, 1 hour = 1¼ days' work.
Shear cylinder courses of boiler, 4 x 1 4
Repairs, 30 x 1 x 4%..... 1
5 per month.

Time, 3 hours = 1⅞ days' work (3 courses included).
Shear smoke arch, 4 x 1..... 4
Repairs, 30 x 1 x 25%..... 7
11 per month.

Time, 2½ hours = 3⅜ days' work.
Shear smoke arch liner, 4 x 1... 4
Repairs, 30 x 1 x 25%..... 7
11 per month.

Time, 30 min. = 5½ hours' work.
Shear expansion sheets, 4 x 1.... 4
Repairs, 30 x 1 x 10%..... 3
7 per month.

Time, 20 min. = 2⅓ hours' work.
Shear brace sheets, 4 x 2..... 8
Repairs, 30 x 2 x 10%..... 6
14 per month.

Time, 1 hour = 1¾ days' work.
Shear sheets for cistern, 4 x 1.. 4
Repairs, 30 x 1 x 10%..... 3
7 per month.

Time, 4 hours = 3½ days' work.
Ashpan hopper and wheel covers, 4 x 1 4
Repairs, 30 x 1 x 30%..... 9
13 per month.

Time, 4 hours = 6½ days' work.
Grease box cases, 4 x 10..... 40
Repairs, 30 x 10 x 25%..... 75
115 per month.

Time, 10 min. = 2⅜ days' work.
Grease box plates, 4 x 10..... 40
Repairs, 30 x 10 x 25%..... 75
115 per month.

Time, 5 mins. = 1¼ days' work.
Fireman's cab, 4 x 1..... 4
Repairs, 30 x 1 x 15%..... 4.5
8.5 per month.

Time, 4 hours = 4¼ days' work.
Engineer's cab, 4 x 1..... 4
Repairs, 30 x 1 x 10%..... 3
7 per month.

Time, 6 hours = 5¼ days' work.
Foot boards, 4 x 4..... 16
Repairs, 30 x 4 x 5%..... 6
22 per month.

Time, 20 min. = 7⅓ hours' work.
Tank cabs, 4 x 1..... 4
Repairs, 30 x 1 x 15%..... 4.5
8.5 per month.

Time, 1 hour = 1 day's work.
Deck plates, 4 x 4..... 16
Repairs, 30 x 4 x 10%..... 12
28 per month.

Time, 10 mins. = 4⅔ hours' work.
Diaphragm plates, 4 x 1..... 4
Repairs, 30 x 1 x 10%..... 3
7 per month.

Time, 15 min. = 1¾ hours' work.
Draft pipe and netting, 4 x 1.. 4
Repairs, 30 x 1 x 10%..... 3
7 per month.

Time, 20 min. = 2⅓ hours' work.
Hopper chutes, 4 x 1..... 4
Repairs, 30 x 1 x 10%..... 3
7 per month.

Time, 20 min. = 2⅓ hours' work.
Coal box for tenders, 4 x 1..... 4
Repairs, 30 x 1 x 10%..... 3
7 per month.

Time, 20 min. = 2⅓ hours' work.
Shoe and wedge liners, 30 x 32 x 75% .....720 per month.

Time, 5 hours' work.
Coal apron, 4 x 1..... 4
Repairs, 30 x 1 x 10%..... 3
7 per month.

Time, 30 min. = 3½ hours' work.
Pilot step, 4 x 2..... 8
Repairs, 30 x 2 x 50%..... 30
38 per month.

Time, 5 min. = 3⅙ hours' work.
Wedge sheets, 4 x 1..... 4
Repairs, 30 x 1 x 10%..... 3
7 per month.

Time, 20 min. = 2⅓ hours' work.
Wind sheets in cab, 4 x 2..... 8
Repairs, 30 x 2 x 10%..... 6
14 per month.

Time, 15 min. = 3½ hours' work.
Cylinder plates, 4 x 2..... 8
Repairs, 30 x 2 x 10%..... 6
14 per month.

Time, 10 min. = 2⅓ hours' work.
Bunter beam sheet, 4 x 1..... 4
Repairs, 30 x 1 x 10%..... 3
7 per month.

* Indicates old machines.

Time, 20 mins. = 2⅓ hours' work.
Cab sheets, 4 x 2..... 8
Repairs, 30 x 2 x 10%..... 6
14 per month.

Time, 10 min. = 2⅓ hours' work.
Tool box, 4 x 1..... 4
Repairs, 30 x 1 x 10% 3
7 per month.

Time, 20 min. = 2⅓ hours' work.
Flag boxes, 4 x 1..... 4
Repairs, 30 x 1 x 10%..... 3
7 per month.

Time, 10 min. = 1⅙ hours' work.
Cab ventilators, 4 x 1..... 4
Repairs, 30 x 1 x 10%..... 3
7 per month.

Time, 10 min. = 1⅙ hours' work.
Total, 61 days' work.....3 machines.
Total time, 60¼ days' work.

PUNCHING.

1—60-in. Throat Punch.
Cleveland Punch, 60-in. Throat Style E. F.
1—36-in. Throat Punch.
1—16-in. Throat Punch.

Flue sheets front and back, 4 x 2..... 8
Repairs, 30 x 2 x 20%..... 12
20 per month.

Time (average), 1¾ hrs. = 4⅜ days' work.
Door sheet firebox, 4 x 1..... 4
Repairs, 30 x 1 x 25%..... 7
11 per month.

Time, 1¼ hours = 1¾ days' work.
Door sheet (back head), 4 x 1. 4
Repairs, 30 x 1 x 10%..... 3
7 per month.

Time, 1 ⅔ hrs. = 1½ days' work.
Throat sheet (firebox), 4 x 1.. 4
Repairs, 30 x 1 x 25%..... 7
11 per month.

Time, 45 mins. = 1 day's work.
Throat sheet of boiler, 4 x 1.... 4
Repairs, 30 x 1 x 4%..... 1
5 per month.

Time, 40 mins. = 3⅓ hours' work.
Crown sheet of boiler, 4 x 1.... 4
Repairs, 30 x 1 x 4%..... 1
5 per month.

Time, 3¾ hours = 2½ days' work.
Crown sheet (firebox), 4 x 1.... 4
Repairs, 30 x 1 x 25%..... 7
11 per month.

Time, 3⅘ hours = 5⅗ days' work.
Side sheets of boiler, 4 x 2.... 8
Repairs, 30 x 2 x 4%..... 2
10 per month.

Time, 2¾ hrs. = 3$\frac{7}{16}$ days' work.
Side sheets of firebox, 4 x 2.... 8
Repairs, 30 x 2 x 27%..... 16
24 per month.

Time, 3$\frac{3}{10}$ hrs. = 10 days' work.
Cylinder courses of boiler, 4 x 1. 4
Repairs, 30 x 1 x 4%..... 1
5 per month.

Time, 8⅕ hrs. = 5⅛ days' work.
Smoke arch, 4 x 1..... 4
Repairs, 30 x 1 x 25%..... 7
11 per month.

Time, 1⅝ hours = 1⅞ days' work.
Smoke arch liner, 4 x 1..... 4
Repairs, 30 x 1 x 25%..... 7
11 per month.

Time, 1 hr. = 1⅜ day's work.
Expansion sheet, 4 x 1..... 4
Repairs, 30 x 1 x 10%..... 3
7 per month.

Time, 15 mins. = 1¾ hours' work.
Brace sheets, 4 x 2..... 8
Repairs, 30 x 2 x 10%..... 6
14 per month.

Time, 45 mins. = 1$\frac{7}{16}$ days' work.
Ash pan hoppers and wheel cover, 4 x 1..... 4
Repairs, 30 x 1 x 30%..... 9
13 per month.

Time, 5 hours = 8⅓ days' work.
Grease box cases, 4 x 10..... 40
Repairs, 30 x 10 x 25%..... 75
115 per month.

Time, 1½ mins. = 3 hours' work.
Firemen's cab, 4 x 1..... 4
Repairs, 30 x 1 x 15%..... 4.5
8.5 p. month.

Time, 4 hours = 4¼ days' work.
Engineer's cab, 4 x 1..... 4
Repairs, 30 x 1 x 10%..... 3
7 per month.

Time, 7 hours = 6 ⅛ days' work.
Running boards, 4 x 4..... 16
Repairs, 30 x 4 x 5%..... 6
22 per month.

Time, 20 mins. = 7⅓ hours' work.
Tank cabs, 4 x 1..... 4
Repairs, 30 x 1 x 15%.....4.5
8.5 p. month

Time, 2 hrs. = 2⅛ days' work.
Deck plates, 4 x 4..... 16
Repairs, 30 x 4 x 10%..... 12
28 per month.

Time, 6 mins. = 2⅘ hours' work.
Diaphragm plates, 4 x 1..... 4
Repairs, 30 x 1 x 10%..... 3
7 per month.

Time, 8 mins. = 1 hour's work.
Draft pipes, 4 x 1..... 4
Repairs, 30 x 1 x 10%..... 3
7 per month.

Time, 15 mins. = 1¾ hours' work.
Hopper chutes, 4 x 1..... 4
Repairs, 30 x 1 x 10%..... 3
7 per month.

Time, 8 mins. = 1 hour's work.
Coal box for tender, 4 x 1..... 4
Repairs, 30 x 1 x 10%..... 3
7 per month.

Time, 15 min. = 1¾ hours' work.
Coal apron, 4 x 1..... 4
Repairs, 30 1 x 10%..... 3
7 per month.

Time, 10 mins. = 1⅙ days' work.
Pilot steps, 4 x 2..... 8
Repairs, 30 x 2 x 50%..... 30
38 per month.

Time, 10 mins. = 6⅔ hours' work.
Wind sheets, 4 x 1..... 4
Repairs, 30 x 1 x 10%..... 3
7 per month.

Time, 20 mins. = 2⅓ hours' work.
Wind sheets, 4 x 2..... 8
Repairs, 30 x 2 x 10%..... 6
14 per month.

Time, 6 mins. = 1½ hours' work.
Cab sheets, 4 x 2..... 8
Repairs, 30 x 2 x 10%..... 6
14 per month.

Time, 3 mins. = 45 mins. work.
Wind sheets in cab, 4 x 2..... 8
Repairs, 30 x 2 x 10%..... 6
14 per month.

Time, 15 mins. = 3½ hours' work.
Cylinder plates, 4 x 2..... 8
Repairs, 30 x 2 x 10%..... 6
14 per month.

Time, 5 mins. = 1⅙ hours' work.
Bunter beam plate, 4 x 1..... 4
Repairs, 30 x 1 x 10%..... 3
7 per month.

Time, 10 mins. = 1⅙ hours' work.
Tool box, 4 x 1..... 4
Repairs, 30 x 1 x 10%..... 3
7 per month.

Time, 30 mins. = 3½ hours' work.
Flag box, 4 x 1..... 4
Repairs, 30 x 1 x 10%..... 3
7 per month.

Time, 10 mins. = 1⅙ hours' work.
Cab ventilator, 4 x 1..... 4
Repairs, 30 x 1 x 10%..... 3
7 per month.

Time, 5 mins. = ½-hour's work.
Tender frames, 4 x 1..... 4
Repairs, 30 x 1 x 4%..... 1
5 per month.

Time, 3⅕ hours = 2 days' work.
Total 67½ days' work ÷ 26 = 3 machines.

1—Punch and Sheer and 25-ft. spacing table.

Cistern sheets, 4 x 1..... 4
Repairs, 30 x 1 x 10%..... 3
7 per month.

1—Flange Punch.*
No. 2 Niles-Bement-Pond Automatic Spacing Punch and Shear on 25-ft. spacing table; Punch to have 24-in. throat.

Time, 2¾ days = 19¼ days' work.
Flue sheets front and back, 4 x 2 8
Repairs, 30 x 2 x 20%..... 12
20 per month.

Time, 25 mins. = 1 day's work.
Throat sheet firebox, 4 x 1.... 4
Repairs, 30 x 1 x 25%..... 7
11 per month.

Time, 45 mins. = 1 day's work.
Throat sheet (boiler), 4 x 1.. 4
Repairs, 30 x 1 x 4%..... 1
5 per month.

* Indicates old machines.

Time, 1 hour, 35 mins. = 1 day's work.
Door sheet (back head boiler), 4 x 1 4
Repairs, 30 x 1 x 4% 1
5 per month.

Time, 45 mins. = 3¾ hours' work.
Door sheet firebox, 4 x 1 4
Repairs, 30 x 1 x 25% 7
11 per month.

Time, 35 mins. = 6½ hours' work.
Total, 4½ days' work.

FLANGING.

1—Hydraulic Flange Press. Chambersburg Universal Flanging Machine.

Back flue sheet, 4 x 1 4
Repairs, 30 x 1 x 20% 6
10 per month.

Time, 45 mins. = 7½ hours' work.
Front flue sheet, 4 x 1 4
Repairs, 30 x 1 x 20% 6
10 per month.

Time, 45 mins. = 7½ hours' work.
Throat sheet (firebox), 4 x 1 4
Repairs, 30 x 1 x 20% 6
10 per month.

Time, 3 hours = 3¾ days' work.
Throat sheet of boiler, 4 x 1 4
Repairs, 30 x 1 x 4% 1
5 per month.

Time, 4 hours = 2½ days' work.
Dome saddles, 4 x 1 4
Repairs, 30 x 1 x 4% 1
5 per month.

Time, 1 hour = 5 hours' work.
Door sheet firebox, 4 x 1 4
Repairs, 30 x 1 x 25% 7
11 per month.

Time, 1 hour = 1⅜ days' work.
Door sheet (boiler backhead), 4 x 1 4
Repairs, 30 x 1 x 4% 1
5 per month.

Time, 2¼ hours = 1½ days' work.
Door holes, 4 x 2 8
Repairs, 30 x 2 x 20% 12
20 per month.

Time, 30 min. = 1¼ days' work.
Steam chest casing, 4 x 2 8
Repairs, 30 x 2 x 10% 6
14 per month.

Time, 12 min. = 3 hours' work.
Cylinder head castings, 4 x 4 ... 16
Repairs, 30 x 4 x 10% 12
28 per month.

Time, 10 min. = 4⅔ hours' work.
Sandbox castings, 4 x 1 4
Repairs, 30 x 1 x 10% 3
7 per month.

Time, 45 min. = 5 hours' work.
Dome casings, 4 x 2 8
Repairs, 30 x 2 x 10% 6
14 per month.

Time, 45 min. = 1¼ days' work.
Total, 15¾ days.

Roll.

1—15-ft. Bending Roll.*

Roll crown sheet of firebox, 4 x 1 4
Repairs, 30 x 1 x 25% 7
11 per month.

1—18-ft. Bending Roll.*

Time, 1 hour = 1⅜ days' work.
Roll side sheets, firebox, 4 x 2.. 8
Repairs, 30 x 2 x 27% 16
24 per month.

Time, 1 hour = 3 days'. work.
Roll crown sheet of boiler, 4 x 1 4
Repairs, 30 x 1 x 4% 1
5 per month.

Time, 1 hour = 5 hours' work.
Roll side sheets of boiler, 4 x 2. 8
Repairs, 30 x 2 x 4% 2
10 per month.

Time, 1 hr. = 1¼ days' work.
Roll cylinder courses of boiler, 4 x 1 4
Repairs, 30 x 1 x 4% (3 courses included) 1
5 per month.

Time, 4½ hours = 2¾ days' work.
Roll smoke arch, 4 x 1 4
Repairs, 30 x 1 x 25% 7
11 per month.

Time, 1½ hours = 2 days' work.
Roll dome, 4 x 1 4
Repairs, 30 x 1 x 4% 1
5 per month.

Time, 45 min. = 3¾ days' work.
Smoke arch ring, 4 x 1 4
Repairs, 30 x 1 x 25% 7
11 per month.

Time, 1 hour = 1⅜ days' work.
Roll smoke arch liner, 4 x 1... 4
Repairs, 30 x 1 x 25% 7
11 per month.

Time, 30 mins. = 5½ hours' work.
Roll cistern sheets, 4 x 1 4
Repairs, 30 x 1 x 10% 3
7 per month.

Time, 4 hours = 3½ days' work.
Roll hopper chutes, 4 x 1 4
Repairs, 30 x 1 x 10% 3
7 per month.

Time, 30 mins. = 3½ hours' work.
Rool draft pipes, 4 x 1 4
Repairs, 30 x 1 x 10% 3
7 per month.

Time, 30 mins. = 3½ hours' work.
Engineer's cab roof, 4 x 1 4
Repairs, 30 x 1 x 4% 1
5 per month.

Time, 30 mins. = 2½ hours' work.
Tank cab, 4 x 1 4
Repairs, 30 x 1 x 10% 3
7 per month.

Time, 30 min. = 3½ hours' work.
Fireman's cab, 4 x 1 4
Repairs, 30 x 1 x 10% 3
7 per month.

Time, 30 min. = 3½ hours' work.
Manhole for cistern, 4 x 1 4
Repairs, 30 x 1 x 20% 6
10 per month.

Time, 20 min. = 3⅓ hours' work.
Total, 18¾ days' work.

Plane.

1—Plate Planer, 30 ft. William Sellers 30-ft. Plate Planer.

Plane crown sheet of firebox, 4 x 1 4
Repairs, 30 x 1 x 25% 7
11 per month.

Time, 1½ hours = 2 days' work.
Plane side sheets of firebox, 4 x 2 8
Repairs, 30 x 2 x 27% 16
24 per month.

Time, 1½ hours = 4½ days' work.
Plane crown sheet of boiler, 4 x 1 4
Repairs, 30 x 1 x 4% 1
5 per month.

Time, 1½ hrs. = 1 day's work.
Plane side sheets of boiler, 4 x 2 8
Repairs, 30 x 2 x 4% 2
10 per month.

Time, 1½ hours = 2 days' work.
Plane cylinder courses for shell, 4 x 1 4
Repairs, 30 x 1 x 4% (3 courses included) 1
5 per month.

Time, 6 hours = 3¾ days' work.
Plane smoke arch, 4 x 1 4
Repairs, 30 x 1 x 25% 7
11 per month.

Time, 1½ hours = 2 days' work.
Plane running boards, 4 x 4.... 16
Repairs, 30 x 4 x 10% 12
28 per month.

Time, 10 min. = 4⅔ hours' work.
N. B.—Available to plane throat sheets, flue sheets and door sheets on flange.
Total time, 16 days' work.

Hydraulic Riveting.

1—Hydraulic Gap Riveter. Chambersburg Locomotive Type Riveting Machine with a gap of 14 ft.; distance between frame and stake 54 in.

Riveting boiler, 4 x 1 4
Repairs, 30 x 1 x 4% 1
5 per month.

Time, 2 days = 10 days' work.

Drilling.

1—6-ft. Radial Drill.*
1—4-Spindle Drill. Foote-Burt Four-Spindle Mud Ring and Flue Sheet Drill.
1—Horizontal Drill. Beaman & Smith No. 0 Special Horizontal Drilling Machine.

Drill plate frames, 4 x 1 ..... 4 sets.
Repairs, 30 x 1 x 75% 22
26 per month.

Time, 3 hours = 9¾ days' work.
Drill bearing bar support brackets, 4 x 3 16
Repairs, 30 x 4 x 10% 12
28 per month.

Time, 10 min. = 4⅔ hours' work.
Drill shaker rods and brackets, 4 x 1 ..... 4 sets.
Repairs, 30 x 1 x 25% ..... 7 sets.
11 per month.

Time, 3½ hours = 4¾ days' work.
Drill tender frames, 4 x 1 4

* Indicates old machines.

* Indicates old machines.

	Repairs, 30 x 1 x 10%..... 3
	7 per month.
	Time, 3 days = 21 days' work.
	Drill plug holes in backhead, 4 x 5 20
	Repairs, 30 x 5 x 4%..... 5
	25 per month.
	Time, 8 min. = 3⅓ hours' work.
	Drill flue holes, 4 x 2 x 350.. 2,800
	Repairs, 30 x 2 x 350..... 4,200
	7,000 per month.
	Time, 24 days' work.
	Drill smoke arch front ring, 4 x 1 4
	Repairs, 30 x 1 x 25%..... 7
	11 per month.
	Time, 6 hours = 8¼ days' work.
	Drill bead iron for cistern, 4 x 1 4
	Repairs, 30 x 1 x 10%..... 3
	7 per month.
	Time, 2 hours = 1¾ days' work.
	Drill dome saddle, 4 x 1..... 4
	Repairs, 30 x 1 x 4% 1
	5 per month.
	Time, 6 hrs. = 3¾ days' work.
	Drill hole for dry pipe in flue sheet, 4 x 1 4
	Repairs, 30 x 1 x 20% 6
	10 per month.
	Time, 1 hr. = 1¼ days' work.
	Drill reinforcing ring, 4 x 1..... 4
	Repairs, 30 x 1 x 20% 6
	10 per month.
	Time, 1 hr. = 1¼ days' work
	Drill bearing bar supports, 4 x 2. 8
	Repairs, 30 x 2 x 25% 15
	23 per month.
	Time, 15 mins. = 5¾ hours' work.
	Total, 77 days' work.
	Drill mud ring, 4 x 1..... 4
	Repairs, 30 x 1 x 10% 3
	7 per month.
	Time, 14 hrs. = 12¼ days' work.
	Flue Work.
Flue Rattler.*	Clean flues, 30 x 350.....10,500 per month.
1—Cutting Off Machine.*	Making safe ends, 30 x 350...10,500 per month.
	Time, 1 min. = 22 days' work.
2—Cutting Off Machines.	Measure and cut to length, 4 x 350 1,400
	Repairs, 30 x 350.....10,500
	11,900 per month.
	Time, 56 days ÷ 26 = $2^{2}/_{13}$ machines.
	Cutting off rough ends, 30x350..10,500 per mo.
	Tome, 16¾ days.
1—Double Head Welding Machine.	Flues scarfed, 30 x 350.....10,500 per month.
	Time, 134 hrs. = 16¾ days' work.
1—Single Head Machine.	Flues welded and swedged, 30 x 350 .....*..10,500 per month.
	Time, 192 days = 24 days' work.
Hartz Flue Welding Machine.	
Hilles & Jones 12-ft. Power Clamp.	Boiler Maker's Power Clamp, 12 ft.
Hydro-Pneumatic Type Mud Ring Portable Riveter.	Portable Mud Ring Riveter.
Niles - Bement - Pond Staybolt Nipper.	Staybolt Nipper.
Chambersburg Hydraulic Accumulator; diam. piston 12 in., stroke 15 ft., capacity 100 gallons; working press. 1,500 lbs.	Hydraulic Accumulator, diameter of piston, 12-in., stroke 15 ft., capacity 100 gallons, working pressure, 1,500 lbs.
Chambersburg Triple Throw Double Acting Electric Driven Hydraulic Pressure Pump.	Hydraulic Pressure Pump.

Recapitulation.

1 60-in. throat shear.
1 36-in. throat shear.
1 bevel shear.
1 72-in. throat punch.
1 36-in. throat punch.
1 16-in. throat punch.
1 punch and shear and 25-ft. spacing table.
1 flange punch.
1 hydraulic flange press.
1 15-ft. bending roll.
1 8-ft. bending roll.
1 plate planer.
1 hydraulic cap riveter
1 6-ft. radial drill.
1 horizontal drill.
1 4-spindle drill.
Flue rattler.
1 cutting-off machine for safe ends.
2 flue cutting-off machines.
2 D. H. welding machines.
1 power clamp.
Accumulator and pump.
Total number of tools, 24.

* Indicates old machines.

NEW TOOLS REQUIRED IN MACHINE SHOP AT OPENING.

Lathes.

1 80-in. driving wheel lathe.
1 26-in. x 10-ft. lathe.
1 32-in. x 12-ft. lathe.
1 48-in. steel-tired wheel lathe.
1 16-in. x 6-ft. lathe.
1 14-in. x 6-ft. lathe.
1 16-in. x 6-ft. lathe.
1 12-in. x 6-ft. lathe. Tool Room.
2 14-in. x 6-ft. lathes, Tool Room.

Turret Lathes.

1 3-in x 36-in. lathe.
1 brass turret lathe, 18 in. x 6 ft.
1 6-in. Gisholt lathe.
1 3-in. x 36-in. lathe.
1 2½-in. x 24-in. lathe.

Vertical Lathes.

4 37-in. rapid production vertical lathes.

Planers.

1 72-in. x 32-ft. frame planer.
1 30-in. x 12-ft. planer, 4 heads.
1 42-in. x 20-ft. planer, D. H.
1 42-in. x 10-ft. planer, D. H.
1 36-in. x 12-ft. planer, D. H.
1 36-in. x 10-ft. planer, 4 heads.
1 36-in. x 12-ft. planer, D. H.
1 48-in. x 12-ft. planer, D. H.
1 36-in. x 10-ft. planer, D. H.

Crank Planer.

3 crank planers, 20 in. x 20 in. x 24-in. stroke.

Shapers.

3 24-in. stroke Morton draw shaper.
1 16-in. stroke shaper, tool room.

Slotters.

1 3-head frame slotter.
1 12-in. slotter.
1 15-in. slotter.
1 18-in. slotter.

Radial Drills.

2 5-ft. radial drill.
2 3-ft. radial drill.
1 4-ft. radial drill.
1 4-head frame drill.

Vertical Drills.

1 44-in. heavy duty compound table.
1 36-in. heavy duty compound table.
1 24-in.heavy duty compound table.

Friction Drills.

3 13-in. friction drills, capacity ¾ in.

Plain Milling Machines.

2 14-in. x 6-ft. plain milling machines.

Slab Millers.

1 48-in. x 16-ft. milling machine.
1 30-in. x 10-ft. horizontal machine (Special).

Vertical Milling Machines.

1 42-in. vertical milling machine, height of spindle 25 in.
1 26-in. x 10¼-in. rotary table, diameter 17 in.
1 B.B. vertical miller, No. 6.

Universal Milling Machines.

1 No. 4 universal milling machine, tool room.

Nut Facing Machine.

1 2-in. nut facing machine.

Bolt Pointers.

1 2-in. bolt pointer.

Centering Machine.

1 4-in. turntable centering machine.
1 2-in. centering machine.

Pipe Nipple Machine.

1 ¼-in. to 2-in. pipe nipple machine.

Bolt Cutter.

1 double-head bolt cutter, ½ in. to 2 in.

Port Miller.

1 port miller.

Boring Mills.

1 7-ft. boring mill.
1 D. H. rod boring machine.
1 48-in. car wheel boring mill.

Grinders.

1 80-in. x 20-in. guide bar grinder.
1 tool grinder for tool room.
1 reamer grinder, tool room.
1 cutter grinder, tool room.
1 die grinder, tool room.
2 twist drill grinders, tool room.

Keyway Cutters.

1 double-head axle keyway cutter.

Hydraulic Press.

1 25-ton hydraulic press for rod bushings.

TOOLS NOT NECESSARY WHEN SHOP IS FIRST OPENED, AS INDICATED BY ASTERISK (*) ON SCHEDULE NO. 1.

1 vertical boring mill.
7 planers.
8 lathes.
2 slotters.
1 crank planer.
3 radial drills.
1 horizontal boring mill.
2 plain millers.
6 vertical drills.
1 brass turret lathe.
1 turret lathe.
1 vertical lathe.

34

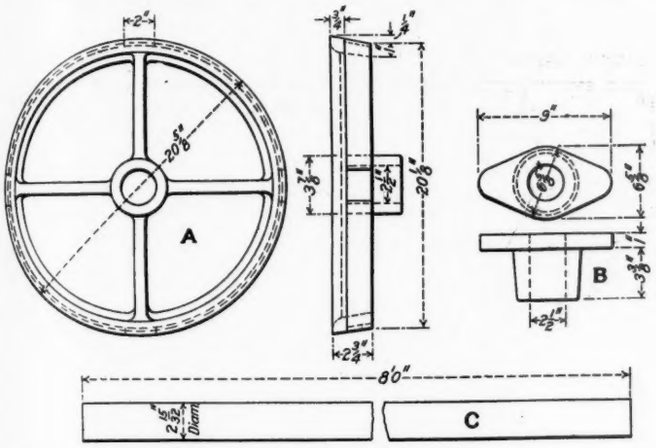
161 tools — 127 = 34, or 21 per cent. less tools.

Shop Kinks.

FROM THE SCRANTON SHOPS OF THE DELAWARE, LACKAWANNA & WESTERN.

SPIDER AND GLANDS FOR SETTING GUIDES.

For many years and in many shops it has been the practice to set the guides of a locomotive by means of a string stretched along the axis of the cylinder and extending back to a point opposite one of the pedestals. It was held at either end by rather frail supports, which, if they happened to be struck, would throw the line out of center and might, if unnoticed, make a mess of the job. In order to obviate this difficulty and provide a solid point from which to take measurements this spider and gland is used. The spider, A, is

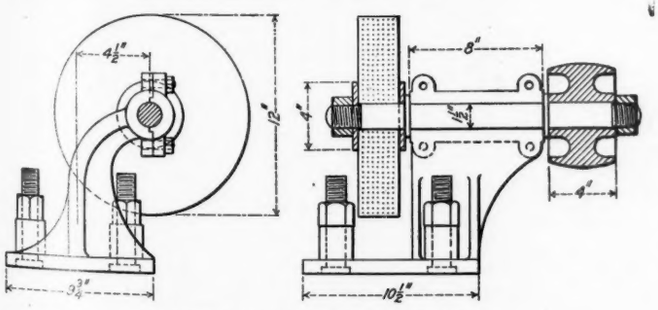


Spider and Gland for Setting Guides.

made of various diameters and has a tapered rim 2¾ in. wide that fits into the bore of the cylinder at the front, where it is held by nuts on the cylinder head studs. The taper of the rim causes the hole at the center to be drawn truly central with the bore. The gland, B, fits into the stuffing box at the back, so that its hole is also central with the cylinder. The bar, B, is then slipped into these two holes, which are in line with each other. As it is 8 ft. long and 2½ in. in diameter, it is long enough to reach to the end of the guides, and stiff enough to hold without bending, and thus furnishes a rigid point from which the guides can be set and lined.

GRINDER FOR TRUCK WHEEL LATHE.

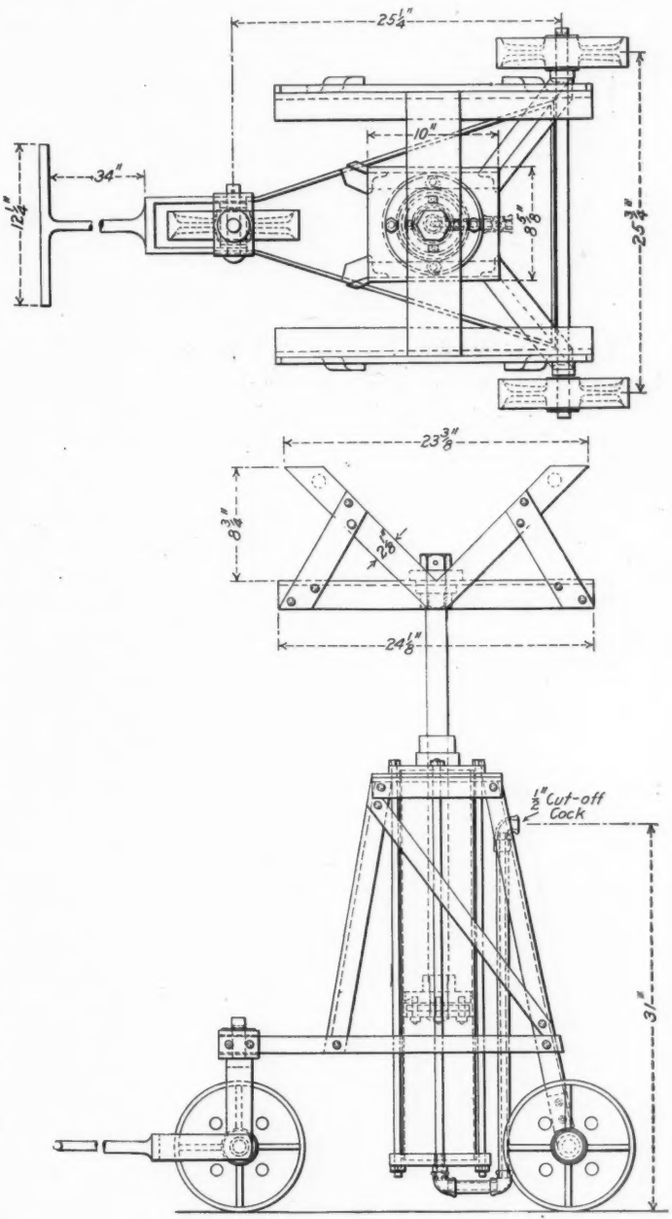
It frequently happens that the journals of an engine truck are worn slightly out of true and need such a small amount of metal removed that it can be done better by grinding than turning. To meet such cases a small base carrying an emery-wheel is a handy tool. The one shown is bolted to the carriage and the wheel is driven from an overhead drum while the axle is revolved in the ordinary manner. In this way the journals can be quickly and accurately brought to true with the removal of the minimum amount of metal.



Grinder for Truck Wheel Lathe.

AIR HOIST FOR MAIN RESERVOIRS.

Blocking and holding main air reservoirs up against the running-boards or other parts of the engine is always troublesome and sometimes dangerous. In order to facilitate this work the portable air-jack illustrated in the accompanying engraving has been designed. It consists of a three-wheeled truck, whose wheels are 10 in. in diameter, with the front pair pivoted and guided in the usual manner by a tongue. The air cylinder is vertical and is formed of a piece of 5-in. pipe, with heads bolted on. It is steadied by a triangulated framing of angles, and has a piston rod 1½ in. in diameter,

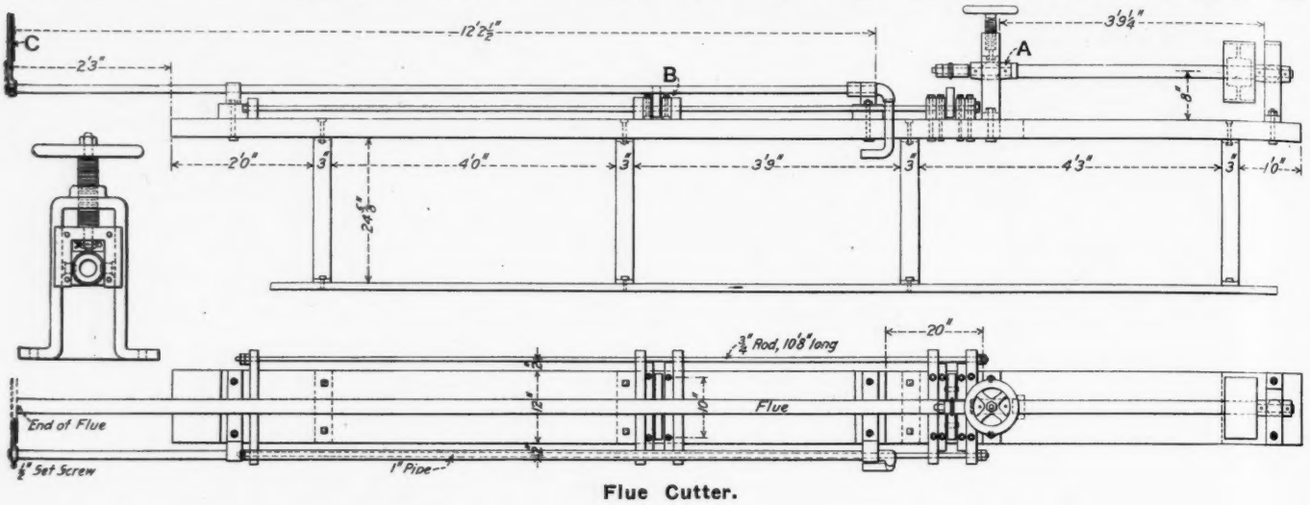


Portable Air Hoist for Main Reservoirs.

the upper end of which carries a cradle adapted to hold a reservoir. Its use is evident. It is hauled to place; the reservoir is put in the cradle; an air connection is made to the piping, and by the admission of compressed air beneath the piston the reservoir is lifted and held in place. In addition to its use for the purpose intended, the men have found it to be a handy tool for a great variety of lifting purposes.

FLUE CUTTER.

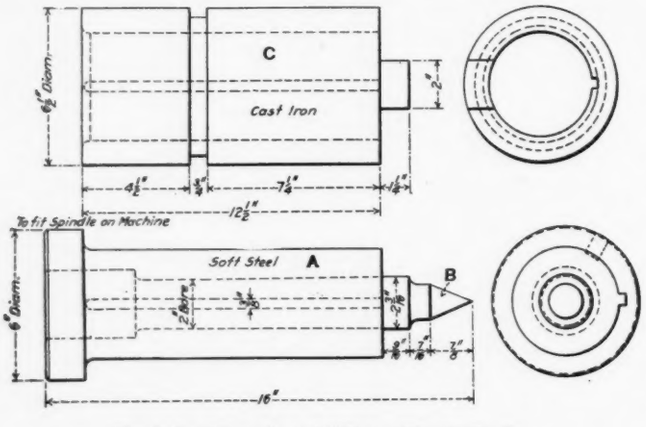
The flue cutter here illustrated does not differ essentially in design from a number of others used elsewhere, but is shown as a matter of record and suggestion to others who may wish to build one. The bed is formed of a piece of timber 3 in. by 12 in. by 16 ft. and is carried by eight legs made in pairs, with a good bracing spread of 3-in. by ⅝-in. iron. The shaft carrying the cutter has a total length of 5 ft. 1⅛ in. and is carried at the back end in a bearing hung in trunnions. Near the cutting end it is carried in a sliding box, A, which can be forced down by the screw and handwheel above. The cutter is 3⅜ in. in diameter and ⅜ in. thick and of the usual form. A pair of idle rollers are disposed directly beneath the cutter for supporting the end of the tube. There is also another pair of idle rollers at B. The length is gaged by an adjustable stop, C. The tube is then simply laid on the rollers with one end against the stop and the running cutter forced down upon it. The cutter is run at a speed of 430 revolutions per minute.



Flue Cutter.

TOOL FOR TURNING LIFT SHAFT ENDS.

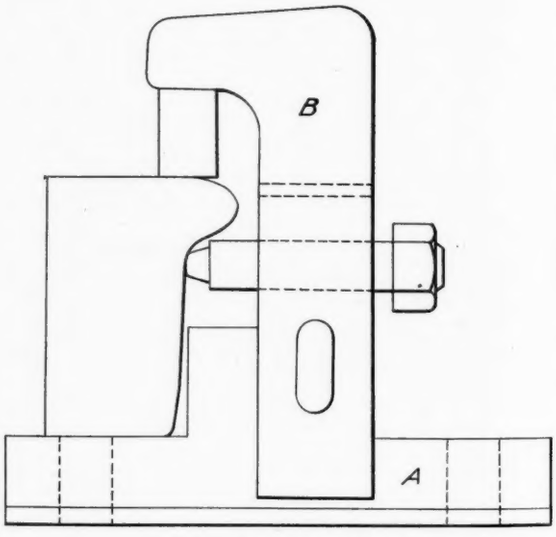
Lifting shafts are difficult to turn in a lathe in the ordinary manner, using a stationary tool, and it has been found to be better to hold the work and revolve the tool. A simple arrangement of this sort consists of a mandrel, A, made to fit the spindle of the lathe and having a center, B, projecting from the other end. A cast-iron sleeve, C, is fitted over the mandrel and prevented from turning by a spline. The face of this sleeve carries a turning tool. The lifting shaft is then supported on this false center, B, and that of the tailstock, with the arms resting against the bed of the lathe. The lathe is started and carries the tool and sleeve with its spindle. These are then fed out over the work by a tool held in the tool-port in the ordinary way and pressing against the left side of the groove in the sleeve.



Tool for Turning Lifting Shaft Ends.

DRIVE FOR BORING MILL.

A sure-and-certain chuck and drive for tires in a boring mill is shown. The bases, A, of which there are four, are bolted to the face plate at proper distances from the center. The tire rests upon the lip, as shown, and then it is centered by the set-screws. The stirrup clamp, B, is then dropped over the base and a key driven home in the slot. This holds the work down so firmly and the turning effect is so great that an exceedingly heavy cut can be taken (½ in. in one case). It is evident that it can be used either inside or outside the tires, so that it is available for both turning and boring.



Drive for Boring Mill.

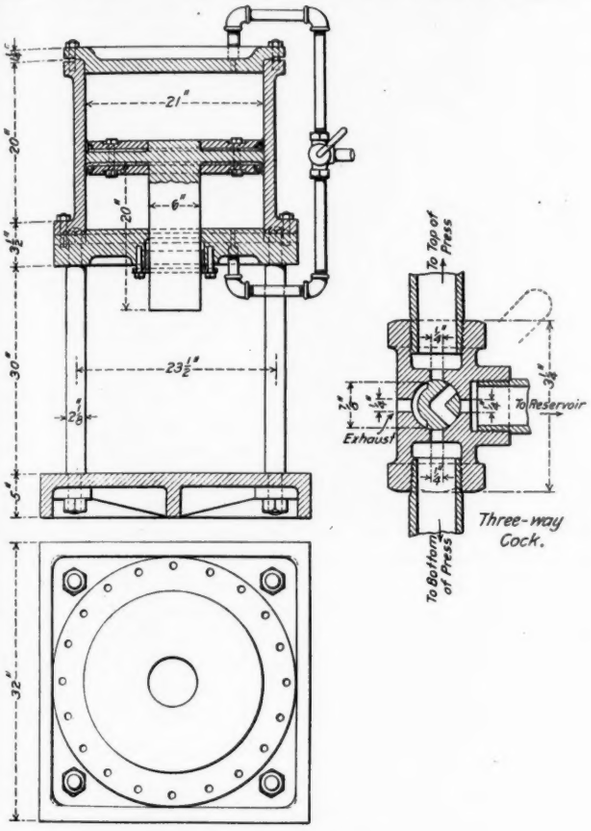
MANDREL FOR TURNING ECCENTRICS.

This consists of a disk 21 in. in diameter and 2½ in. thick, with a taper mandrel projecting on one side, with its center 2½ in. from the center of the disk. A sleeve bored with an inside taper to fit the mandrel and of an outside diameter equal to that of the eccentric to be turned is slipped over the solid one. The disk is bolted to the face plate and the eccentric slipped on over the sleeve and bolted in the proper position. It is then turned in the usual way, with the surety that the throw will be correct and all surfaces in proper relationship.

PNEUMATIC PRESS.

Long ago, when we first learned that compressed air was adaptable to many uses, someone designed a pneumatic press with an inverted cylinder for pressing bushings in rods,

brasses in driving boxes and doing similar work. At Scranton there is such a press. It has a cast-iron cylinder 21 in. in diameter in which there is a piston with double-cup leather packings, so that there is no leakage in either direction. The plunger is 6 in. in diameter and is given a stroke of 8 in.

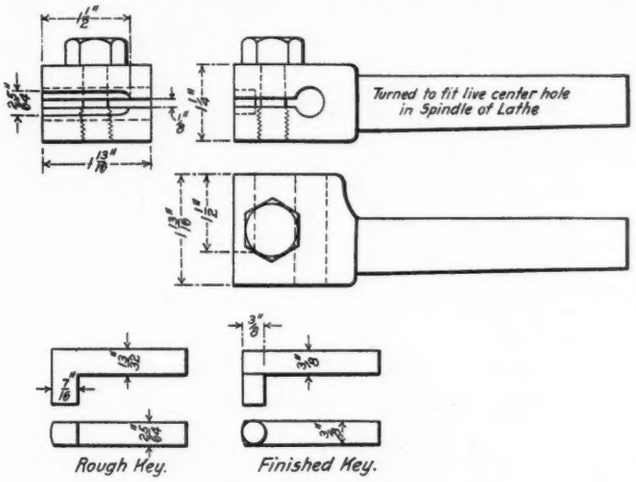


Pneumatic Press.

With 90 lbs. air pressure the press is capable of exerting a pressure of almost 4,000 lbs. The base is a stiff iron casting, tied to the cylinder by four 2⅛-in. columns, which are, however, turned down at the ends to 1⅝ in., thus forming a bearing shoulder of ¼ in. at each end. The three-way cock that is used can be made to exhaust from one end of the cylinder while admitting air to the other, or can blank all ports.

CHUCK FOR TURNING KNUCKLE-JOINT KEYS.

The knuckle-joint key for the side rods of mogul and consolidation locomotives has a teat ⅜ in. diameter and ½ in. long projecting from the side at one end. It is a troublesome thing to get at because of its small size and position.

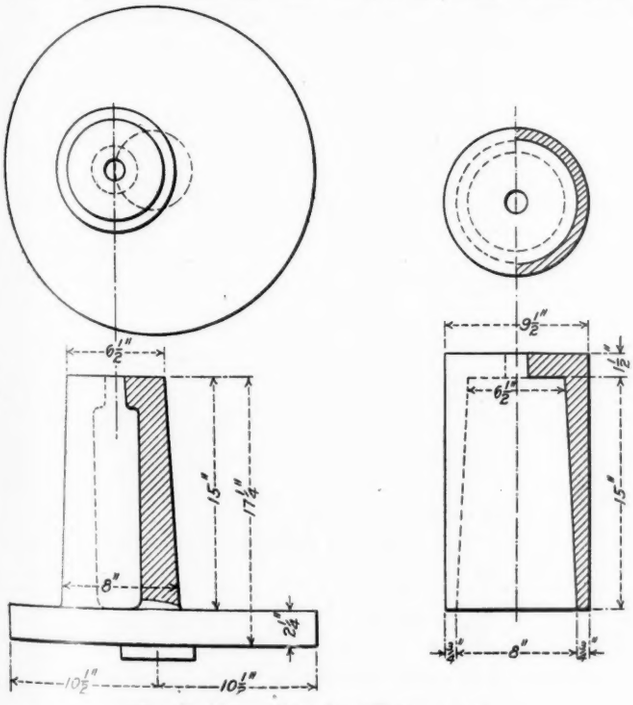


Chuck for Turning Knuckle Joint Keys.

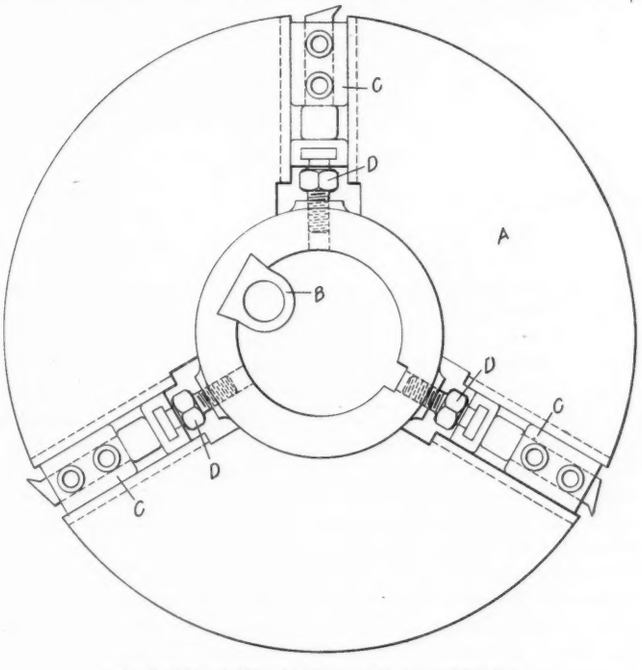
To do the work, a small chuck has been designed that is fitted with a shank to fit in the live center hole of the lathe spindle. The projecting head is split and provided with a set-screw for clamping. The outer end of the slot is cut out so that the shank of the key can be put in. Tightening of the top bolt fixes the key and leaves the teat projecting so that it can be turned quickly and accurately.

TOOL HEAD FOR BORING PISTON VALVE CHAMBERS.

This is a traveling head set on a boring bar and moved along the same by a screw feed. It is not new in design, but may be of value to those who have none. The head itself is of cast-iron in the form of a disk, A, of a diameter to meet that of the chest. It is bored and key-seated to fit a 3-in. boring bar and its spline. Opposite the key-seat there is another and broader one, dove-tailed, to take the feed nut, B.



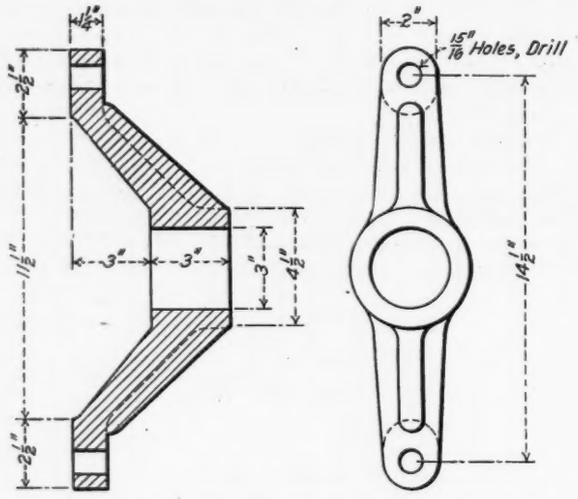
Mandrel for Turning Eccentrics.



Tool Head for Boring Piston Valves.

The tool-holders, C, are set in T slots cut in the face of the disk, and these are adjusted by the screws, D, that are threaded radially into the hub, and have a head that fits the tee of the tool-holder itself.

At the ends of the valve chambers the bar is held by a guide-head bolted fast by means of the valve chamber head studs.



Head for Boring Piston Valve Chambers.

DIAGRAM OF VALVE-SETTING MACHINE.

This shows an exceedingly simple arrangement for revolving the driving wheels during the process of valve setting. The line shaft is merely extended out on one side and is fitted with a worm gear, into which a worm meshes. The stem of the latter is made to fit an air motor, which may be attached and used as a driver.

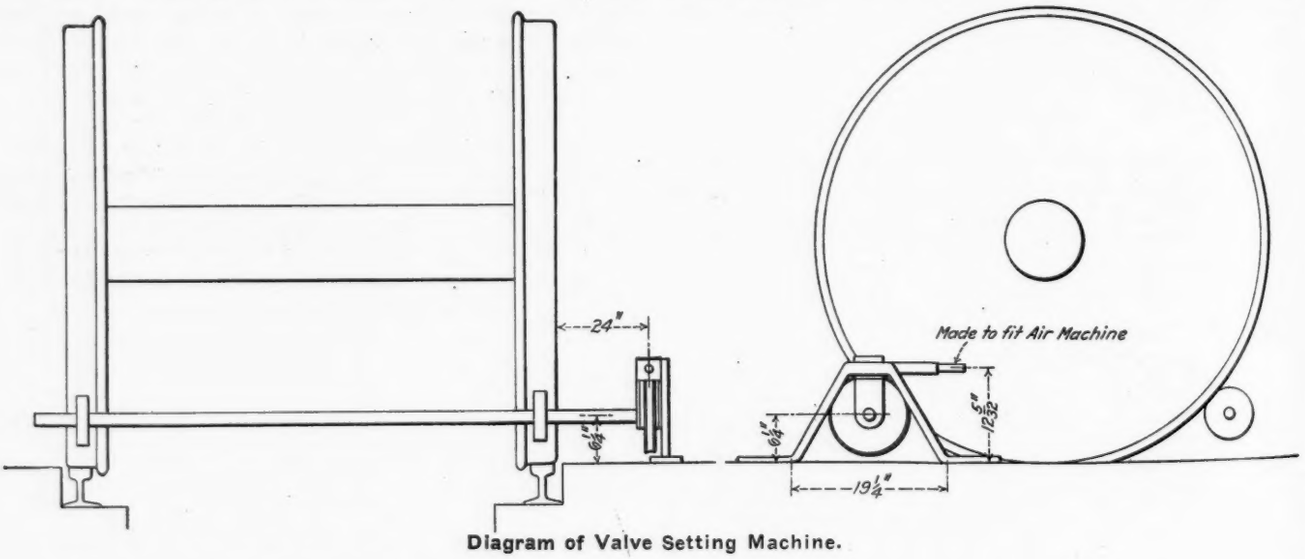
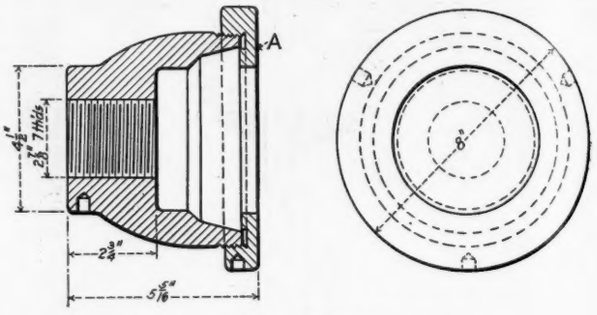


Diagram of Valve Setting Machine.

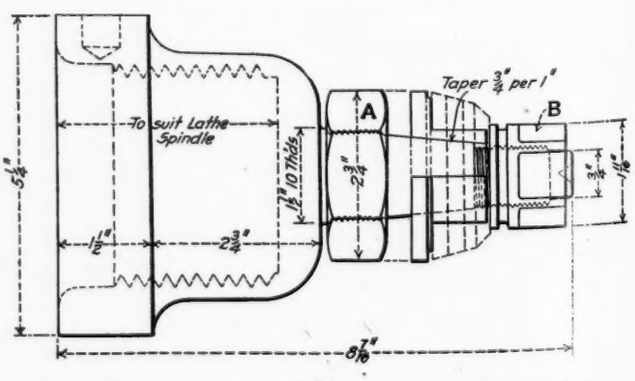
DEVICES FOR MAKING METALLIC PISTON ROD PACKING.

The devices in use for the making of metallic packing rings for piston rods and valve stems start with the molding of the rings and cover each successive step until they are completed. The molding machine is a modification of a regular molding machine in that it mechanically draws the core after the ring has been cast. In the machine, a photograph of which is reproduced, the top plate is bored out to form three dies or molds, into which the metal is poured. The cores of these molds are held up in place by the three stems that project down and are attached to the crossbar, A. This crossbar is moved up and down by the piston rod coming from the small cylinder at the base. This cylinder is about 3 in. in diameter, with a 3-in. stroke of piston. When air is admitted to the bottom of the cylinder the cores are held up in place and the mold is ready for pouring. After the rings have cooled air is admitted to the upper end of the cylinder, the cores are pulled down and the rings are readily removed.

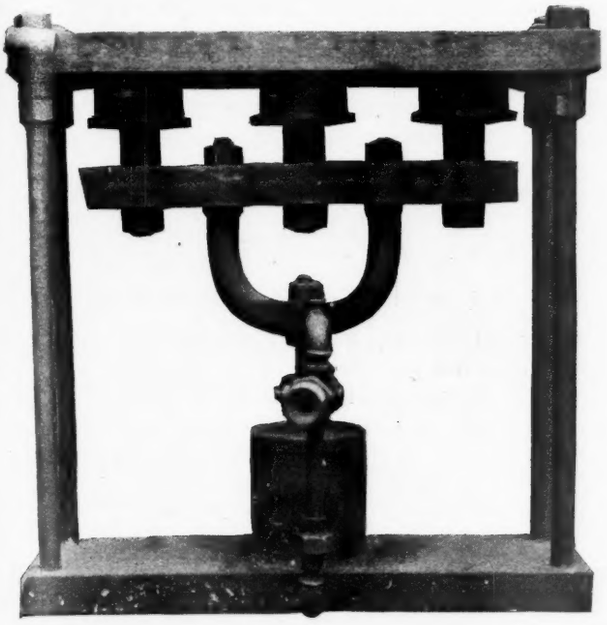
For the turning of the rings there is a special expanding mandrel. This is made to screw on to the end of a lathe spindle in the place of a face plate. Beyond the hub in which the screw thread is cut there is a projecting mandrel, cut with a thread for the nut, A, then with a taper to take the expander, and at the end with a thread for the tightening nut, B. The expander is of the usual type of ring, cut to permit of being expanded as it is forced on to the taper. The operation is very simple; the packing is slipped on over the expander, as indicated by the dotted lines, and the tightening nut drawn home. After turning, the expander is backed off by the nut, A. Another chuck, screwing on to the lathe spindle, is used for boring out. This chuck is bored out on



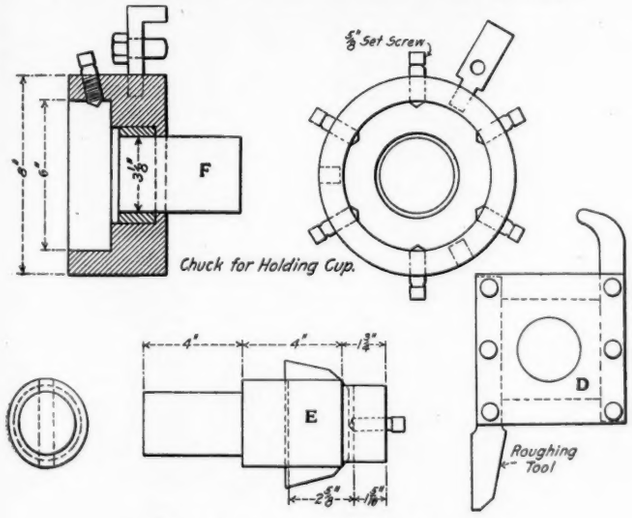
Chuck for Boring Packing Rings.



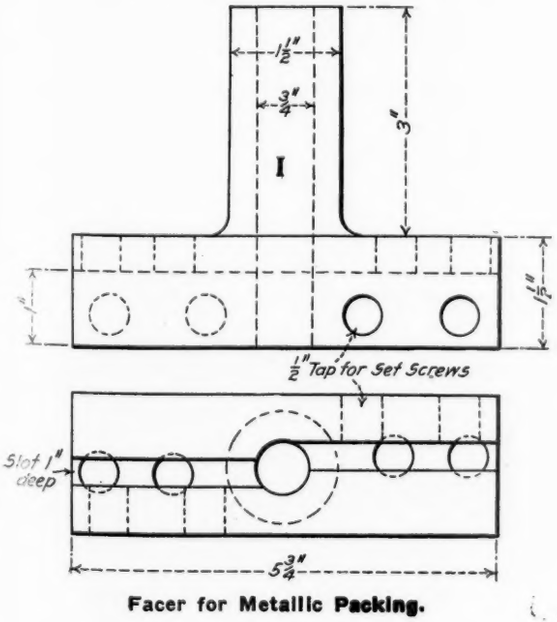
Expanding Mandrel for Turning Piston Rod Packing.



Molding Machine for Piston Rod Packing Rings.



Tool for Forming Vibrating Cups.

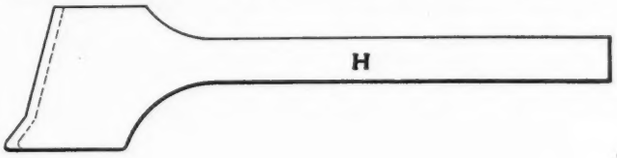


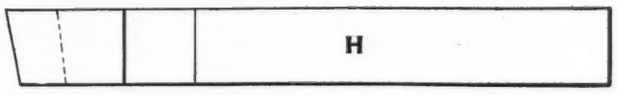
Facer for Metallic Packing.

the face to receive the ring, which is held in place by the nut, A.

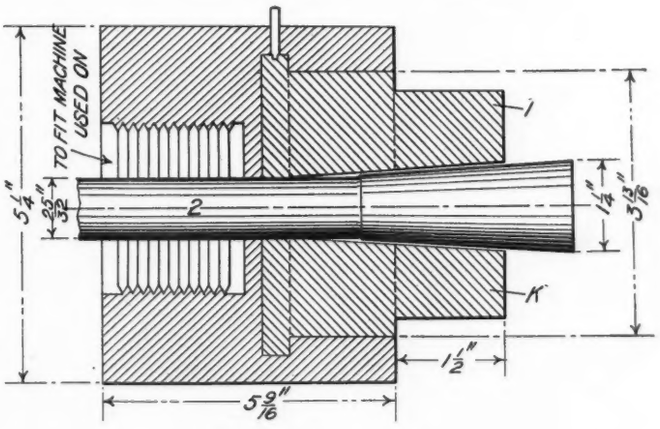
The tool used for forming the outside of the rings with these chucks is shown at H. It is held in the ordinary tool post and is simply fed down against the ring as it turns in the chuck.

Another form of chuck is that shown in K. It requires that a lathe shall be fitted to receive it, and this has been done, an old turret lathe being used for the purpose. The body of the chuck is screwed on to the spindle, which is hollow. The expanding rings (1) are set in this body and are cut with the flare away from the head. The taper mandrel has a long stem (2) extending through the spindle to the back, where a handle is attached that comes around to the front of the lathe within easy reach of the operator. The movement of this handle is limited by stops, so that the man-





Tool for Forming Metallic Packing.



Metallic Packing Chuck.

drel cannot be thrown out too far. This makes the chucking of the ring an exceedingly rapid operation and leaves the outside and one end accessible.

The tool used for facing the rings with this is shown at I. It consists of a head carrying a flat-blade tool which is pushed up against the ring.

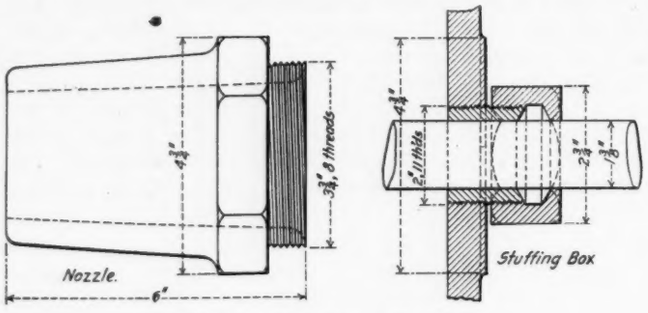
The chuck and tools used for its forming of the vibrating cups are shown in D, E and F. The stem of the chuck is made to fit the machine that is used, and the cup is held by set-screws. The holder, D, is set on a vertical spindle and turned so as to bring either the roughing or boring tool into play. The inside is finished with the tool, E.

GREASE COMPRESSOR.

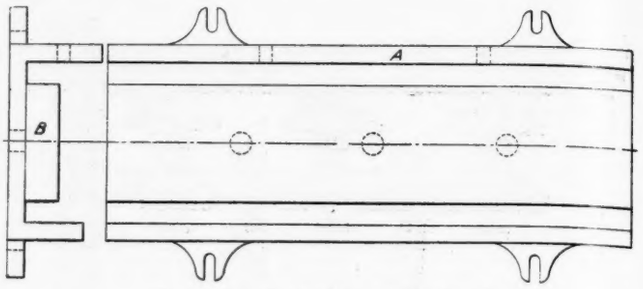
A home-made affair consisting of three cylinders in tandem, with pistons connected by a common rod. They are each 10 in. in diameter. Two are for air which serves to compress the grease and the third (the one on the end at the left) is for the grease. This has a hole 4 in. by 6 in. cut in the side at the inner end for the insertion of the grease, and at the other end a nozzle of the proper inside diameter

is screwed. These nozzles are 1½ in., 2 in. and 2½ in. in diameter, respectively.

The three-way cock is located, as indicated, between the intakes at the two ends of the center cylinder. This makes it possible to admit an air pressure to the back end of the two air cylinders for compression, but when the compression has been completed and the pistons are to be drawn back, the air is exhausted from the two back ends and admitted to



Grease Compressor Nozzle.

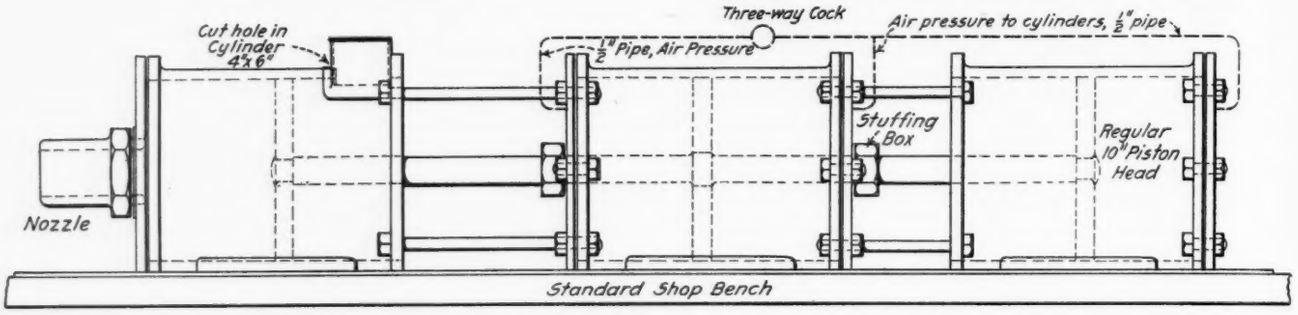


Form for Babbitting Crossheads.

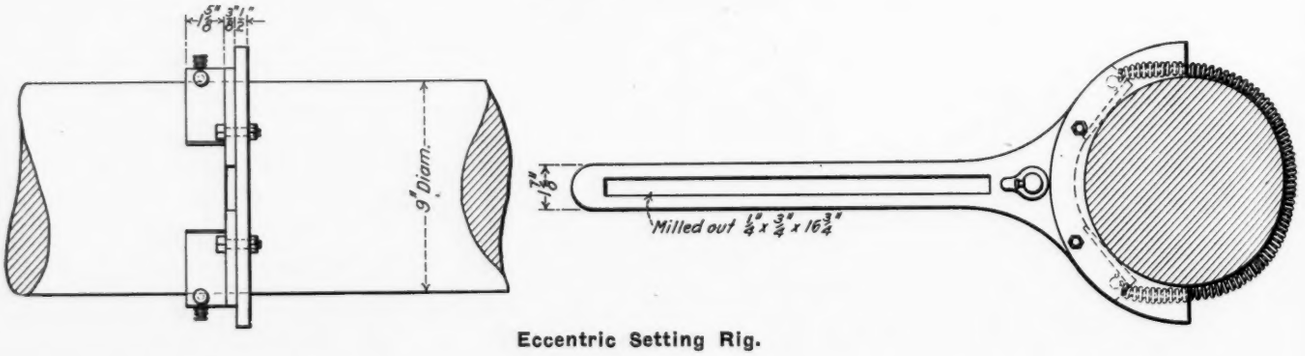
in the vertical flanges at the side. The box is clamped down in the usual manner.

SUPPORT FOR PLANING DRIVING BOXES.

A two-faced beam is used on the double-headed planer for planing driving boxes. It is a casting 4 ft. long and fitted with three T slots in each face, to which the boxes are bolted in rows by means of the usual clamps. With the beam once set square with the cut of the planer, it is merely neces-



Grease Compressor.



Eccentric Setting Rig.

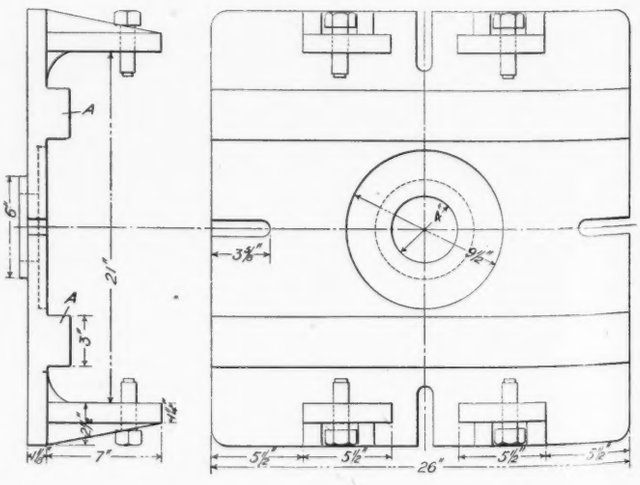
the front end of the center cylinder only, as this will give sufficient pressure for retraction.

ECCENTRIC-SETTING RIG.

Although the Stephenson link motion may be disappearing, there are still a goodly number at work, and it still remains to set the eccentrics accurately on the axle. The rig used at Scranton for this purpose consists of a half-circle, H, made to fit the axle, with a long arm attached for adjusting. It is held in place by a spring that spans the axle under tension. At 1 and 2 there are marks indicating the location of the radius leading to the front and back eccentrics, respectively. The slotted arm carries a pointer that can be adjusted to the center of the crankpin. When this has been properly set the location of the keyways for the eccentrics are scribed on the axle at 1 and 2 and the work is done.

CHUCK FOR BORING DRIVING BOXES.

The driving boxes are bored on a boring machine and are held in a simple cart chuck, with a short projecting teat that fits the center hole of the faceplate. The box rests upon the parallel pieces, H A, and is adjusted centrally by set-screws



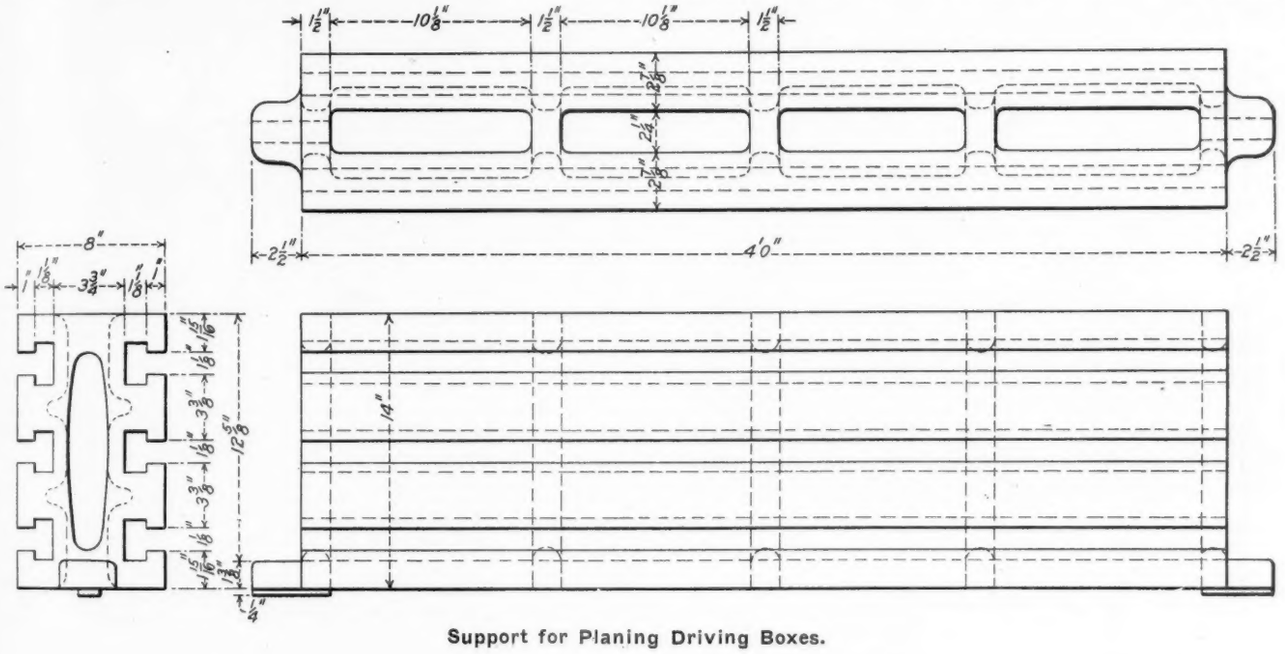
Chuck for Boring Driving Boxes.

sary to bolt the boxes against the face to insure truth in the alinement of the planing.

ARRANGEMENTS FOR BABBITTING CROSSHEADS.

In accordance with what is now common practice, the crossheads are babbitted for their sliding shoes to a finished fit and without requiring any machine work to be put upon them. For this purpose there is a cast base in the center of which a plug is set that is made to enter the piston-rod fit. This holds the flanges vertical. Then after the crosshead has been heated the U-clamps, H, are set over the flanges. In order that this method may be efficient, it is necessary that the flanges should be planed accurately to a standard height, so that the distance between faces of the wearing surfaces may be exact. The U-clamp has a filler strip, B, doweled on the inside, the thickness of which is such that, if subtracted from the height of the flange on each side, it will leave the faces the proper distance apart.

In using this arrangement, one side is babbitted at a time and two ladles are used in the pouring, so that the metal runs down the sides and fills in at the bottom. This is done because if an attempt were made to pour in at the bottom and let the metal spread from there to the sides it would chill and be defective. The thickness of the babbitt liner is from ⅛ in. to ¼ in., and the men become so skillful in the pouring

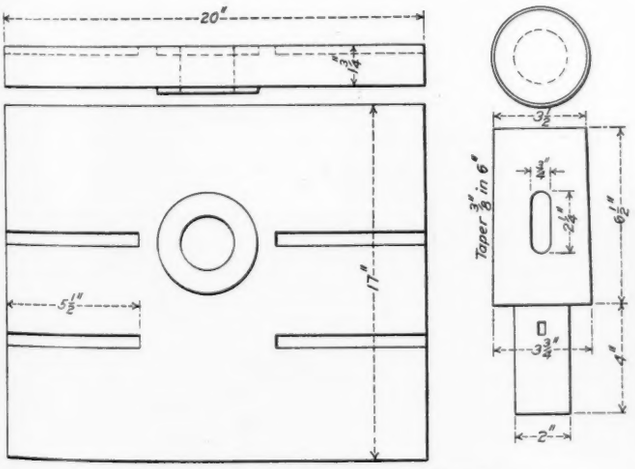


Support for Planing Driving Boxes.

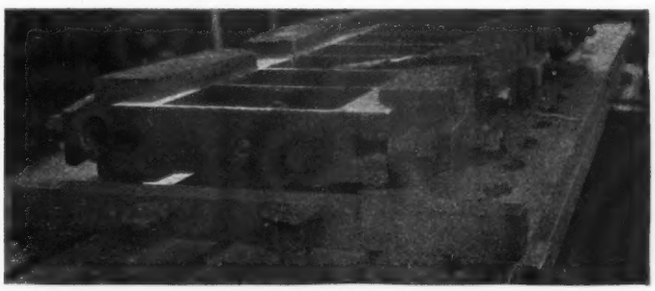
into this narrow opening that not a spoonful will be spilled. Of course, the metal is tinned before the babbitt is poured in order to secure a proper adherence.

PLANING DRIVING SHOES AND WEDGES.

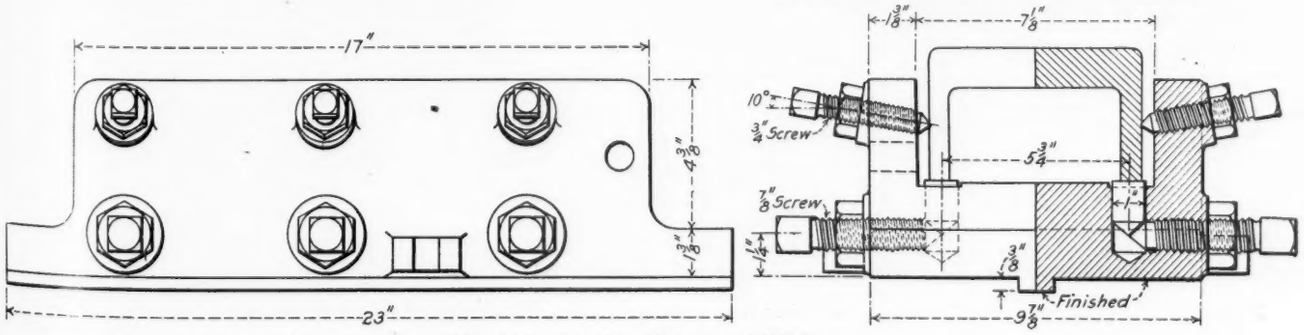
The reproduction of the photograph shows the method of planing the sides and edges of the shoes and wedges. There



Device for Babbitting Crossheads.



Method of Planing Driving Box Shoes.



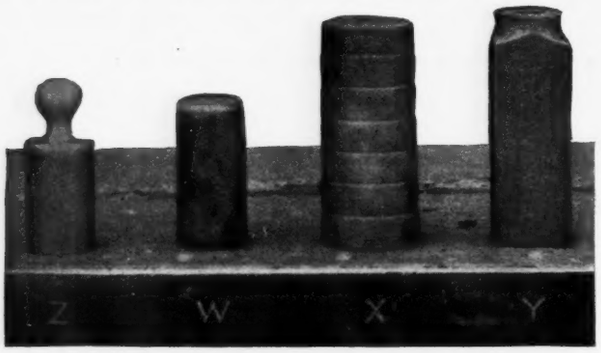
Chuck for Planing Shoes and Wedges.

is a long casting bolted to the planer, over the edges of which the shoe and wedge castings are straddled and held. The rubbing faces are finished in a chuck, a section and elevation of which is shown in the line engraving. The flanges rest on dowel pins that have a conical end and which can be forced up by a set-screw entering from the side and having a similar end. This adjustment made, the casting is held down and in place by the downwardly projecting set-screws, which have sharp points that grip the piece and hold in the usual manner.

MINOR GAGES.

Among the minor gages in use in the shop upon which much depends, there are four shown in the accompanying photograph.

One of these, marked X, is used for keeping the piston rods accurately to size. On it there are a series of rings, 7 in number, carrying by increments of 1-32 in. These are all stamped and numbered and a corresponding number is stamped on



Minor Gages.

W = *center for turning valve yokes.*
X = *piston rod gage.*
Y = *block gage for standard bolts.*
Z = *block gage for tapered end of valve stem yoke.*

the rod. Then when a rod is turned it is brought to one of these diameters and stamped, and from this mark the packing rings are selected and issued.

A second, marked Y, is a block bored out to the proper taper to take standard bolts and to which they are all fitted.

A third, marked Z, is a gage similarly bored, with a taper hole, to which the tapered end of the valve yoke is fitted.

The fourth, marked W, is more of a shop tool or kink. It is quite common for valve yokes to be so abused in their removal from the valve rod sockets that the centers are either destroyed, or, at least, so mutilated, that they cannot be used. This block, W, is bored to fit over the tapered end of the yoke, and at its end it carries a good center that can be used in the lathe when it becomes necessary to turn the stem.

ECCENTRIC MANDREL.

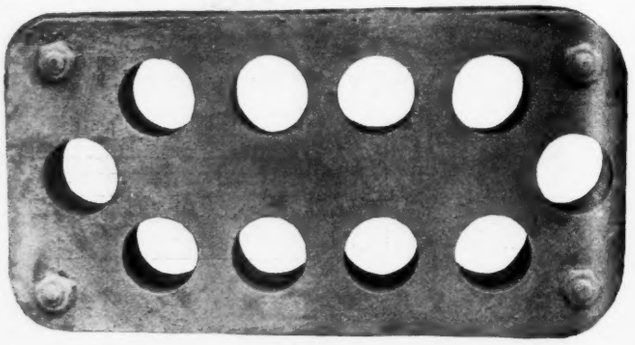
This tool, marked M on the accompanying photograph, is merely a heavy mandrel with a key set in it and of sufficient length to take four eccentrics at once. At the ends there are crank arms that have centers cut in them, so that the proper throw can be given the eccentrics being turned.

CROSSHEAD MANDREL.

On the same photograph, with the eccentric mandrel lying in front of it, marked N, there is a handy mandrel that is used for turning the brass on the crossheads about the piston fit. There is a taper sleeve near one end, with the larger diameter towards that end, which is to enter the piston fit. The mandrel is, therefore, put in through the crosshead, which is held in place by the nut in the end (see photograph).

GAGE FOR WRIST PINS.

Similar in principle, but differing greatly in size from the piston rod gage, is the gage for wrist pins. This is shown in the accompanying reproduction of a photograph. It consists of two plates, each about ¾ in. thick, and held about 2½ in. apart by bolts and separators. The holes shown are bored to standard diameters and marked, and serve as a guide and gage for the turning of the pins.



Wrist Pin Gage.

MANDREL FOR TURNING CROWN BRASSES.

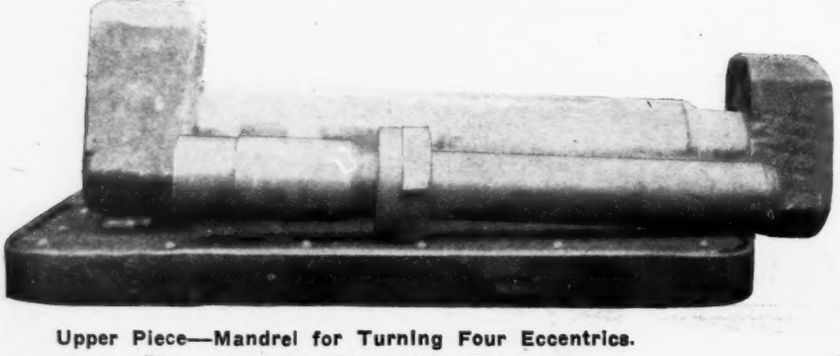
This mandrel consists of a heavy base slotted at the edges to admit a holding bolt, and with a mandrel projecting upwardly, to the end of which a sliding collar and nut are fitted. The brass is set on the lower collar and the upper one dropped down and adjusted with the set-screws and then tightened in place by the nut. It is intended for use on the boring mill.

JIGS FOR SETTING AIR PUMPS.

The two photographs on next page show a set of jigs that are in use for setting air pumps on locomotives. The larger jig, A, is used for marking and drilling the holes in the boiler for the bracket studs, and the smaller ones for drilling the holes in the bracket, so that it will not only fit in place on the boiler, but will take the pump. The general form can be seen from the photograph, but the dimensions and proportions will depend, of course, upon the boiler and the location of the pump.

ROCKER BOX MANDREL.

This is shown in a reproduced photograph on the next page,



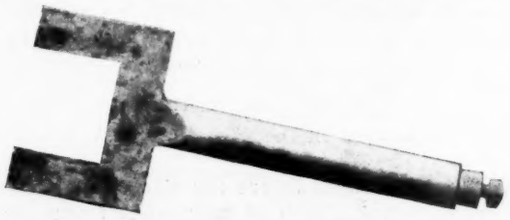
Upper Piece—Mandrel for Turning Four Eccentrics.
Lower Piece—Crosshead Mandrel for Turning Bars.

Mandrel for Turning Crown Brasses.

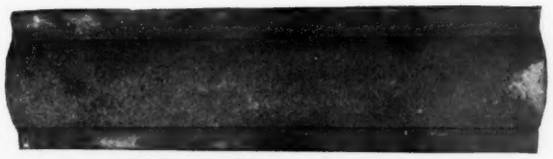
and is merely a hollow half-round mandrel used in the babbitting of rocker boxes.

BORING MILL BAR.

This is a boring bar that is used for light work in the boring mill, and can be held in the ordinary tool post. The two forks are of rectangular section and slip under and are



Boring Mill Mandrel.



Mandrel for Babbitting Rocker Boxes.

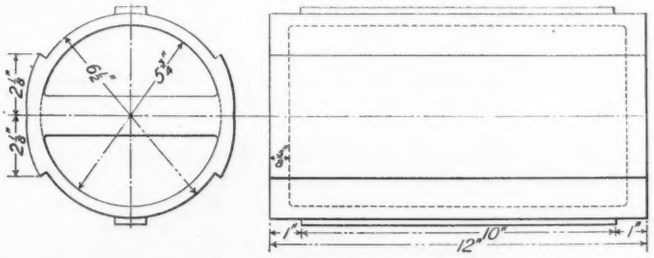
held by the ordinary tool clamp. It can be put in place as quickly as the regular cutting tool and is correspondingly handy.

MANDREL FOR BABBITTING ENGING TRUCK BOX BRASSES.

Engine truck box brasses are babbitted by means of a hollow mandrel like that shown. The projection, 1 in. wide at the top, lays against the crown of the brass and protects the oil grove. In the same manner the lip at the side comes against the side of the brass and leaves the open space between, into which the babbitt is poured.

HAMMER FORGINGS.

The 3,500-lb. steam hammer in the blacksmith shop is made to do a wide variety of work by the foreman, T. F. Buckley, that it was not designed to perform. This is along the line of making die forgings of intricate shapes and designs, such as are usually turned out of the drop press. In a reproduction

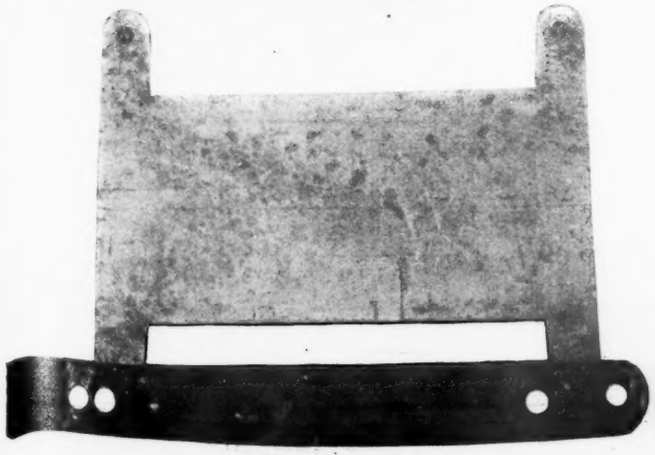


Jig for Babbitting Truck Axle Brasses.

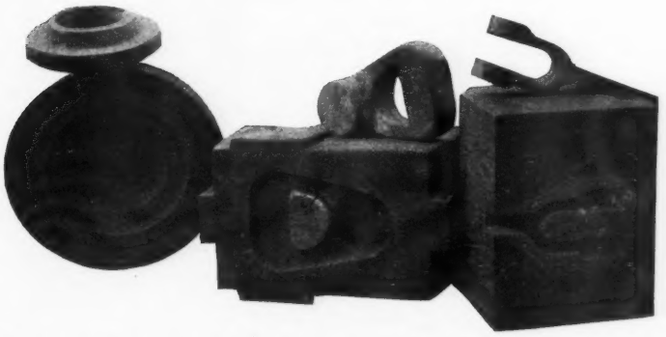
of a photograph three of these dies are shown, with the forgings made from them on top. The dies are of cast iron and are used just as they come from the sand, with the exception of the planing required to fit them to the anvil and the hammer head. In short, there is no die-cutting whatever either in the metal or in the pattern. The method of making the dies is to first make a wooden model of the piece to be forged. This is used as a pattern for the formation of a plaster-of-paris matrix, which is attached to the face of the standard pattern body. It is from this combination that the sand mold is made, the only care being that the face and the matrix of the die shall be smooth and true. As a molder can make two sets of these dies complete in a day, and as the iron goes directly back to the cupola again when the die is worn out, the cost is very low, since the only other labor required is that of fitting dowel pins and holes so that the two parts will come together truly, and to planing, to fit the hammer head and anvil, of the two parts, respectively.

In casting the ordinary run of iron as it comes from the cupola for the regular machinery, castings of the road are used. Hence the iron cost is only that of melting and the

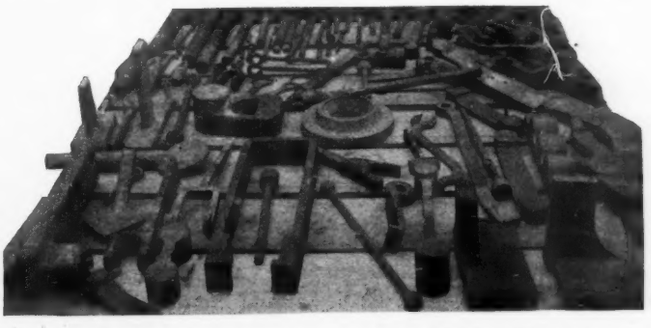
Jig for Setting Air Pumps.



Jig for Setting Air Pumps.



Samples of Forgings and Dies in Which They Were Made.



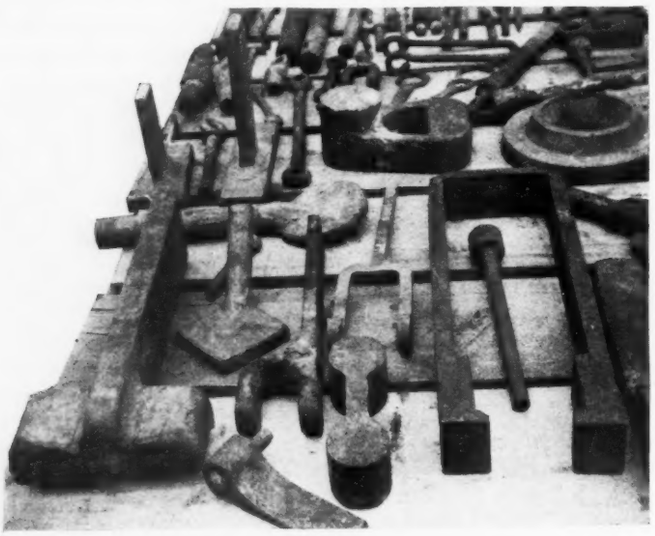
Samples of Die Forgings Under Hammer (Fig. 3).

waste of the planer chips, as the die goes back to the foundry as first-class machinery scrap.

In the use of the dies, the operation does not differ essentially from that of making drop forgings. The metal is heated to a welding temperature and is laid dripping on the dies. The head then strikes good heavy blows until the two faces are together and the work is done.

The average life of such dies runs from 80 to 100 pieces. As to form, they run the whole range of what may be required for locomotive work. The illustrations show better, perhaps, than any description what that range and variety is. Here will be found a variety of pins headed in many ways,

Samples of Die Forgings Under Steam Hammer (Fig. 1).

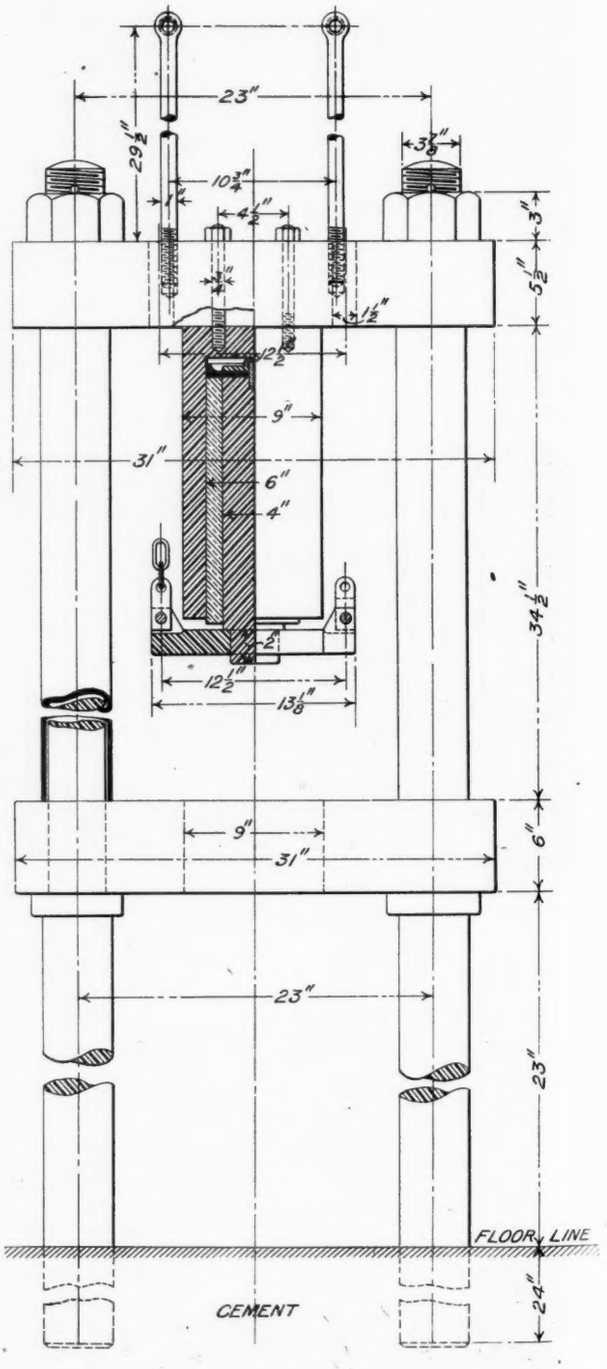


Samples of Die Forgings Under Steam Hammer (Fig. 2).

jaws for transmission rods, coupler yokes, guide yoke brackets, fire hose and hooks. So that there seems to be hardly anything of too complicated a form to be made in this way, and it is evident that even for the small quantity of some of these forgings that are used, economy realized by this method of making in comparison with the regular hammer and anvil work is very great. Add to this the fact that parts are made in what is practically exact duplicates, with the minimum of allowances for machine finishing, and that saving is still further enhanced. This, it will be borne in mind, is just the contrary to what is done in regular forge work, under the modern regime of rapid and heavy machine work, where it is cheaper to cut away and waste the metal than it is to pay for close forging. But when, as in this case, it is as cheap to forge close as it is to forge with big finishing allowances, we have three economies rolled together: that of rapid blacksmith work; that of close forging, with the decrease of waste metal, and of saving of labor in the machine shop, all of which go far to recommend this method of die forging for all kinds of duplicated work. In fact, it might even happen that duplication would not be necessary in order to make the die work a paying investment.

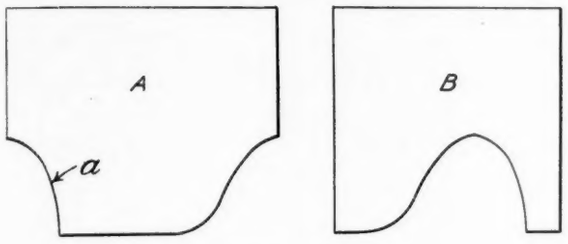
FINISHING TOOL FOR TIRES.

The tool that is used on the wheel lathes for finishing the flanges of steel wheels is shown in the accompanying engraving at A. It is arranged to cut one side of the flange at a time instead of cutting both at once, as is frequently done with a tool shaped as at B. The cutting edge, *a*, dresses



Hydraulic Press, for Pressing Locomotive Rod Bushings in or Out of Rods.

the working side of the flange and at the same time the flat surface of the tool finishes the tread. The tool is then drawn back and the cut made at the back. It is claimed that this will be done in less time than will be required with the tool shown at B, which cuts both sides at once, because of the heavier cut that can be taken, and, in addition to this, the tool is much more easily kept in condition, because when it



Tire Finishing Tool.

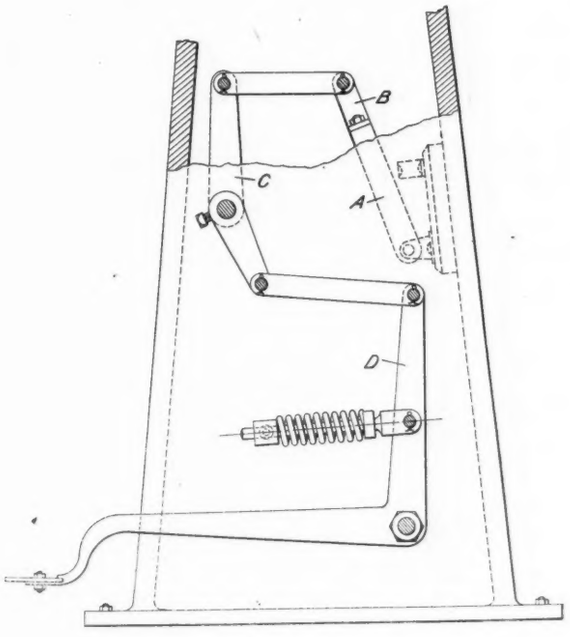
wears or becomes dull it can be sharpened without cutting back so as to build up the flange recess, as is necessary with B.

HYDRAULIC PRESS FOR ROD BUSHINGS.

This press is arranged in the same general manner as that of the pneumatic press for box brasses and miscellaneous work. The table stands on four substantial legs that are embedded in a concrete base and which extend up to and through the upper plate, which is held in position by 3⅞-in. nuts. The cylinder is inverted and is bolted to the lower face of the upper plate. It is 6 in. in diameter and is fitted with a bushed plunger. The lower end of the plunger sets into a hole, against the sides of which a shoulder has a bearing in a crosshead to which lifting chains are attached. These chains pass over T cheaves in set on the uprights at the top and carry retracting weights at their ends. These serve to draw the plunger up after it has done its work and the pressure has been removed.

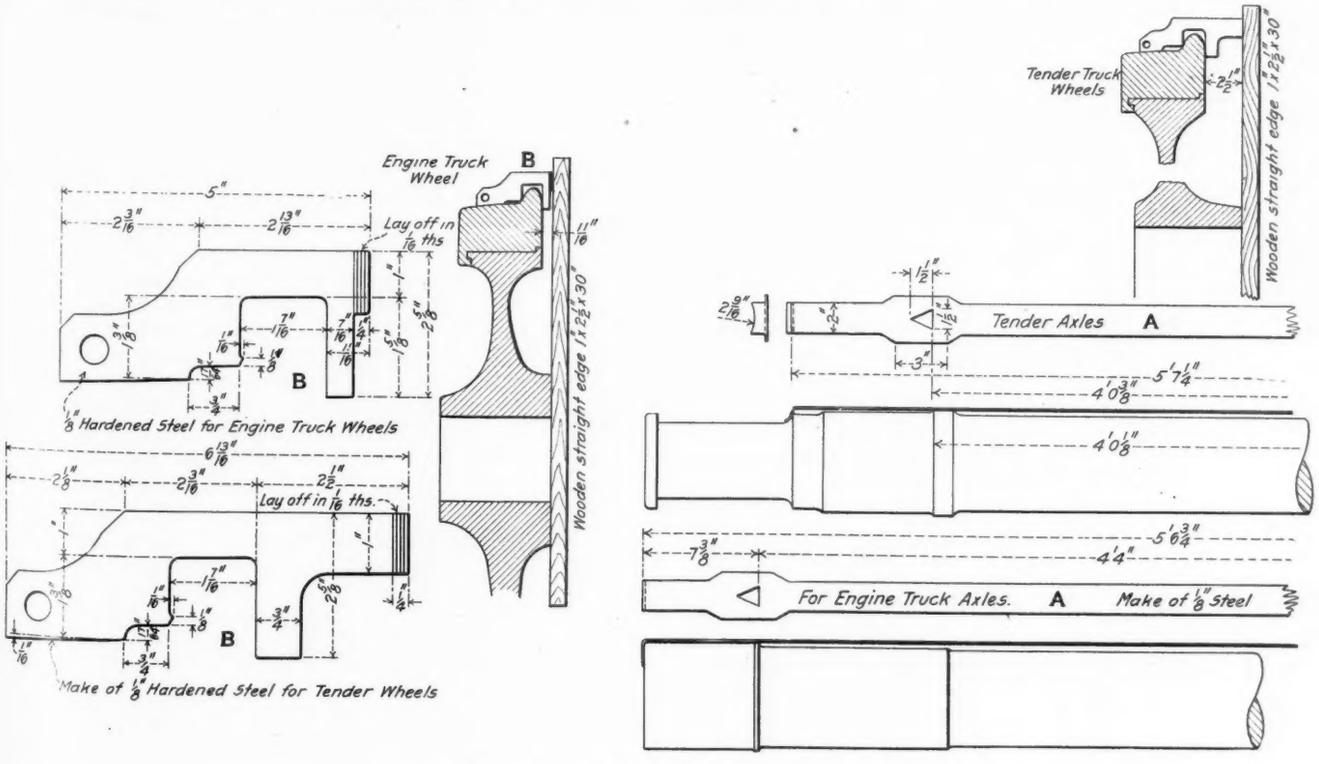
EMERY WHEEL SWITCH.

It is well known that an emery wheel requires a considerable amount of power when running, even though no grinding is being done. It is also unfortunately true that the men who use the wheel are very careless about shutting off the power when they are through using it. In order to save this waste of power a treadle device for throwing the switch is used. The original switch, A, has an extension, B, bolted on, and this, through the two connections and the lever, C, is connected with the upper arm of the lever, D. This lever



Emery Wheel Switch.

is pivoted at its lower extremity on a fixed shaft and has a bell-crank extension, at the end of which there is a treadle. Midway up this a lever, A, there is a helical spring which bears against a stop on the machine. When the machine is to be used the operator puts his foot on the treadle and by pressing it down throws the switch in and closes the motor



Gages for Mounting Engine and Tender Truck Wheels.

circuit. He holds his foot on the treadle while he is at work, and when he lifts it to go away the spring throws out the switch and the wheel stops.

FLUE WELDER.

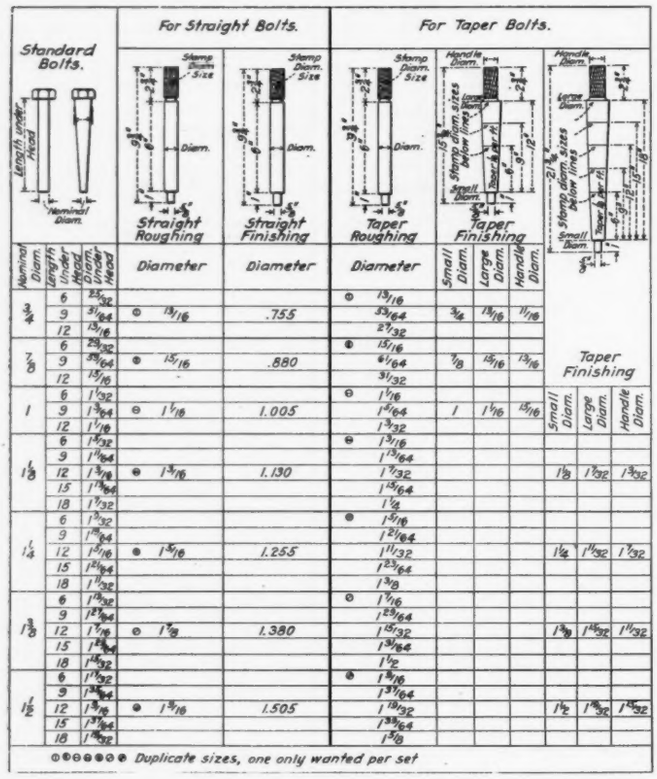
There is a novel arrangement in the flue shop for welding and swaging flues. The shop was originally possessed of a single flue-welder of the usual roller type. This served to weld the flues. In order to have it do the swaging at the same heat, another machine of exactly the same type was bought and placed alongside. The two are now on the same base and are strongly tied together and are driven by a common driving pinion set between their gears. This pinion was the original drive of the first machine. This drives the two heads in the same direction, and as soon as a safe end is welded on it is pushed into the swager and finished. This, in combination with the oil furnace, enables the work to be turned out with great rapidity.

STANDARD TAPER BOLTS.

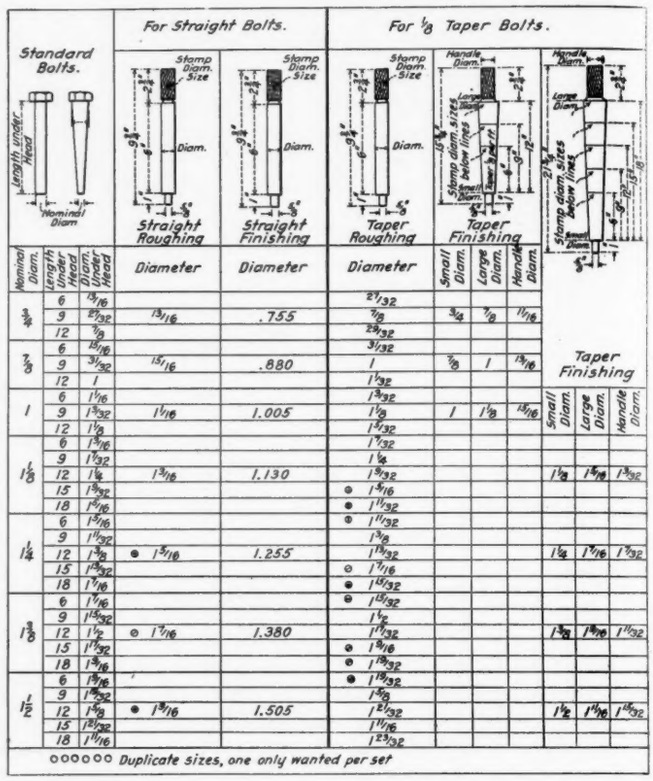
There are two standards of taper bolts in use on locomotives. For the cylinder and frame bolts a taper of 1-16 in. to the foot is used, and for the rods a taper of ⅛ in. to the foot. Regular schedules have been adopted for the making of all sizes and lengths of these bolts, and these are shown in the accompanying table.

GAGES FOR MOUNTING ENGINE AND TENDER TRUCK WHEELS.

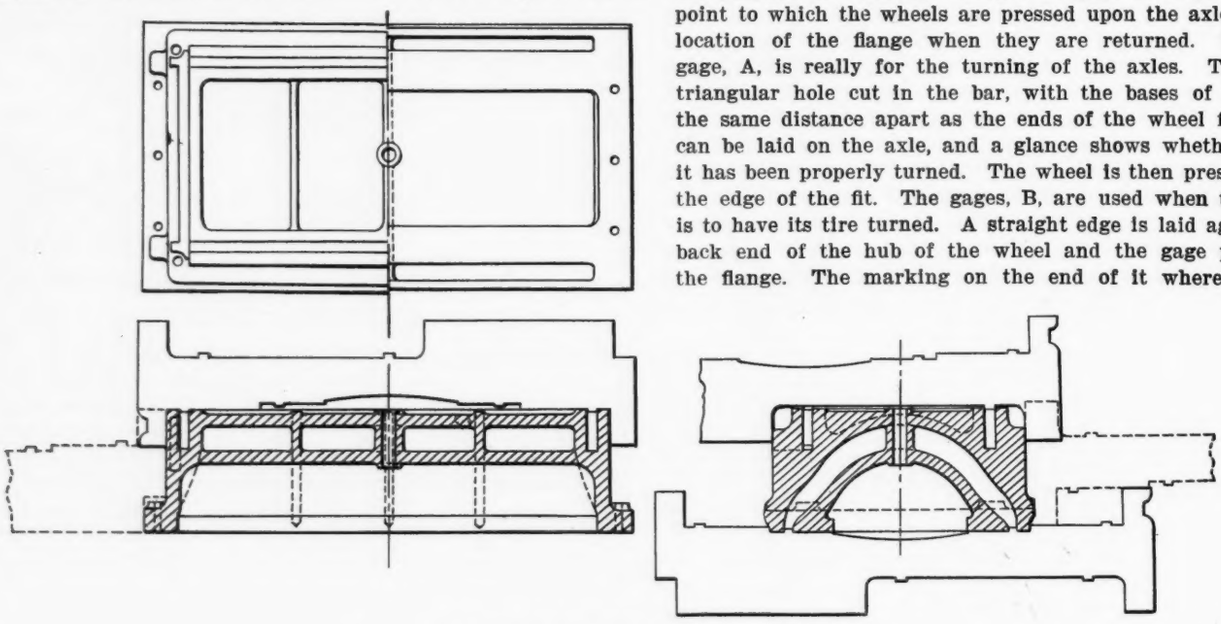
These gages are intended for use in the mounting of steel tires and steel wheels on engines and tenders, and are for the purpose of securing accuracy in gage by regulating the point to which the wheels are pressed upon the axle and the location of the flange when they are returned. The long gage, A, is really for the turning of the axles. There is a triangular hole cut in the bar, with the bases of the holes the same distance apart as the ends of the wheel fits. This can be laid on the axle, and a glance shows whether or not it has been properly turned. The wheel is then pressed on to the edge of the fit. The gages, B, are used when the wheel is to have its tire turned. A straight edge is laid against the back end of the hub of the wheel and the gage placed on the flange. The marking on the end of it where it abuts



Plug Gages for Bolt Turning Machine (Fig. 1).



Plug Gages for Bolt Turning Machine (Fig. 2).

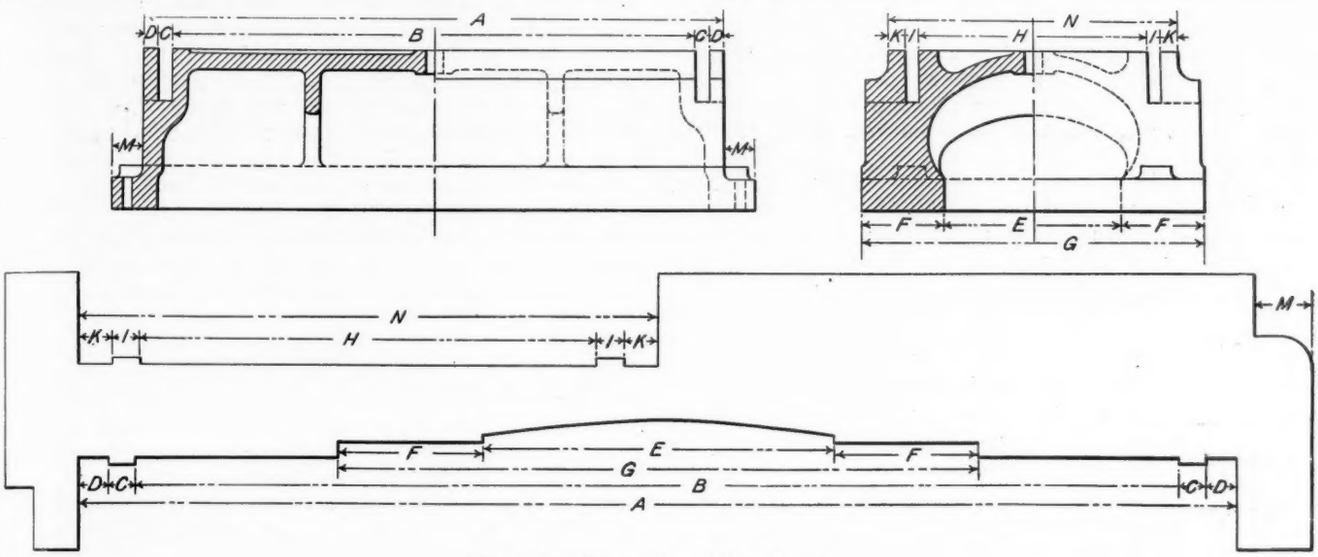


Gages for Inspecting Slide Valves.

against the straight edge will show whether the flange has been properly located or not. With these it is possible to put the wheels on the axles with the minimum of variation from the truly correct position.

GAGES FOR FINISHING AND INSPECTING SLIDE VALVES.

For each size of slide valve in use there is a gage that contains on its edge all of the essential measurements of the valve for which it is intended. Two examples of these gages are shown. In one case the application of the gage to the valve is shown, and in the other the gage is shown on a larger scale, and the measurements on it are indicated by letters corresponding to those on the valve itself. From this it will be seen that the length, width and location, with its width of the groove for the packing ring in the back; the width and the exhaust opening in the face and the width of the flange at the end are given. Where there is a flange at the side, this is also put on the gage. These gages are made of steel about ⅛ in. thick.



Gages for Inspecting Slide Valves.

AMERICAN RAILWAY ASSOCIATION.

A report of the fall meeting of this association was given in our last issue, page 1030. Following are some additional details from the committee reports:

Committee on Maintenance.—This committee presented a two-page history of what has been done during the past 15 years to establish standard dimensions for box cars. This was prepared by J. J. Turner, who was long at the head of the committee on that subject. Mr. Turner presents statistics showing that in Western classification territory the increase in the use of very large cars has been stimulated by a scale of minimum carload rates for bulky goods which does not place sufficient penalty on the large car; while in Official and Southern classification territory, where freight tariffs have been adjusted more rationally to the sizes of the cars, the use of unstandard cars has been much more successfully restricted. By making the minimum weight too small the roads in western territory have not only given undue encouragement to the use of large cars in their own territory, but have been the means of doing the same thing in Eistern territories.

Figures are given showing the better progress toward a standard car that has been made in the eastern and southern states. In the eight years from January 1, 1901, to January 1, 1909, the number of cars smaller than the standard—that is to say, less than 36 ft. long—decreased from 84 per cent. of the total box car equipment to 42 per cent., and the decrease was about the same in all territories. In the same eight years the number of cars 36 ft. long increased from 10 per cent. of the total box car equipment to 39 per cent., but the increase was much smaller in the Western classification territory than in the eastern and southern states. The figures showing the number of cars over 36 ft. long show, however, in eight years an increase in Western territory from 6.3 per cent. of the total box car equipment to 25.7 per cent., while in Official and Southern territory the increase was only from 5.5 per cent. to 12.9 per cent.

Committee on Electrical Working.—This committee has considered the effect of electrical working of railways on automatic signaling systems, and says that it would seem advisable that in new automatic signal work alternating currents should be employed for the track circuits, and this not only on roads which contemplate the adoption of electric traction, but also where electric traction is or may be employed on roads nearby.

Relations Between Railways.—The committee on this subject gives in its report a copy of the working agreement of the Cincinnati Joint Interchange Bureau, and some information about the American Railway Clearing House. The Clearing House (for settling car interchange balances) now has offices in both New York and Chicago, and the list of members includes 68 railways and three private car lines. The clearings for the month of August amounted to $1,600,000, an increase of about $200,000 over March last. Accounts are kept with 464 railway companies and 370 private car lines. The total assessment to subscribers for the month of September was $180, and the cost to the subscribers, which was about 2 cents for each mileage or per diem report, is no more than formerly they had to pay for postage and stationery in mailing reports. With over 50 reports consolidated into one at this office, a benefit is conferred on all roads in the country, as they have fewer settlements to make. All corrections of errors are settled by the companies with each other.

Explosives.—The committee on this subject, reviewing the work of the Bureau for the past six months, urges all roads to join the Bureau, declaring even that, according to the terms of the rules prescribed by the Interstate Commerce Commission, roads which are not members of the Bureau are not conforming to the law. Ten steamship companies are now members of the Bureau and 32 manufacturers of explosives are associate members. Excessive placarding of cars, which was a considerable annoyance, has been done away with. Answering criticisms that "inflammable" placards are used too much, the committee says that these are necessary to enable employees to keep such cars away from those containing explosives, and to warn men not to enter the cars with lanterns or torches. At the same time it must not be thought that the card justifies failure to enter a car to extinguish a fire.

THE ELECTRIC SYSTEM OF THE GREAT NORTHERN AT CASCADE TUNNEL.*

BY CARY T. HUTCHINSON.

The first three-phase installation on a trunk line railway in the United States was put into operation early in July of this year at the Cascade mountain tunnel on the Great Northern Railway, in the state of Washington, about 100 miles east of Seattle.

In general the plant comprises a hydroelectric generating station, operating under a head of 180 ft., having a capacity of approximately 5,000 k.w. in generators at 6,600 volts and 25 cycles; a transmission system operating at 33,000 volts, delivering energy to a sub-station where it is transformed to 6,000 volts, at which pressure it is supplied to the overhead conductors and to the locomotive by way of an overhead trolley; on the locomotive the pressure is reduced by three-phase transformers to 500 volts for the supply of the four three-phase motors with which each locomotive is equipped.

The Great Northern Railway crosses the Cascade mountains

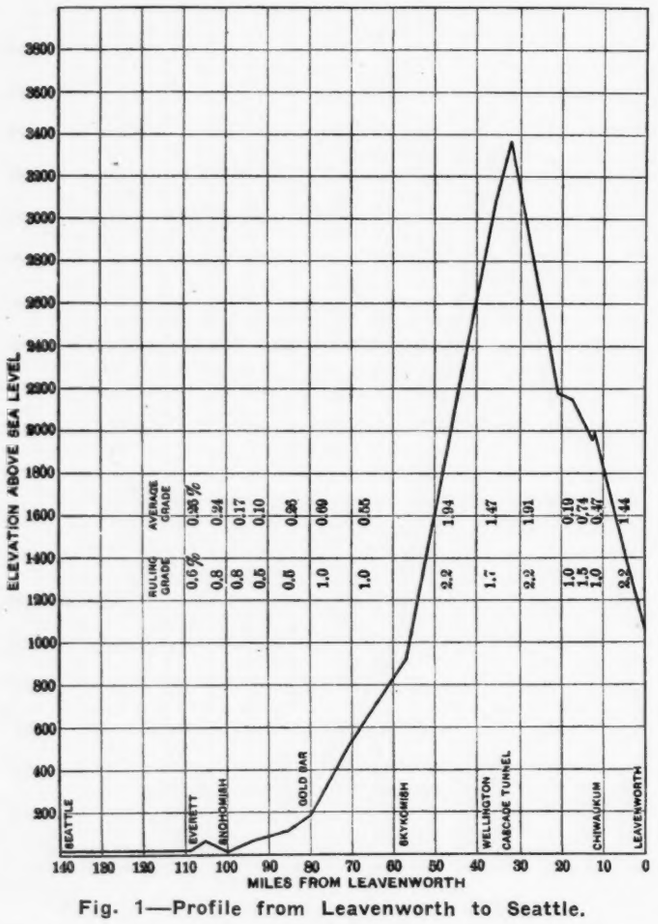


Fig. 1—Profile from Leavenworth to Seattle.

through a tunnel 13,873 ft. long; this tunnel is on a tangent and has a uniform grade of 1.7 per cent.; rising to the tunnel from Leavenworth, on the east, the ruling grade is 2.2 per cent. and 21 per cent. of the total distance of 32.4 miles from Leavenworth to the tunnel is on the ruling grade. From Skykomish on the west to the summit the ruling grade is 2.2 per cent., and 44 per cent. of the distance of 24.8 miles is on the ruling grade. The average up grade from Skykomish to Wellington is 1.94 per cent. and from Leavenworth to Cascade, 1.37 per cent.

The operation of the tunnel with steam locomotives was at all times difficult and frequently very dangerous on account of the heat and smoke from the locomotives. Crows' Nest coal, which is exceptionally free from sulphur and gas-forming materials, was used for the tunnel service. It was the custom to clean the fires of each locomotive and to put on just sufficient coal to carry it through the tunnel. In the tunnel the rails became very wet from condensed steam, and were frequently covered with a layer of coal soot and ground sand, making them very slippery. The temperature in the locomotive cab was almost unbearable, rising at times as high as 200 deg. fahr. Under ordinary circumstances it required from 20 minutes to an hour for the tunnel to clear itself of gases, but on days when the wind was changeable, the passage of the gases from the tunnel would be stopped by the change in the direction of the wind, and they would pocket. Under such circumstances, work in the tunnel was very dangerous. There are refuge chambers containing telephones every quarter of a mile, but it was a difficult matter to keep these instruments in order on account of the gases, smoke and moisture.

The tunnel is lined with concrete throughout its length, and is in good condition. The roof is practically dry. The entire tunnel drips more or less from condensed steam just after the passage of a train, but is comparatively dry at other times. The temperature changes at the top of the tunnel are very rapid, varying from atmospheric temperature to several hundred degrees fahr. from the heat of the locomotive exhaust. For these reasons this tunnel is the limiting feature to the capacity of the Great Northern Railway for hauling freight across the mountains.

Mallet compound engines are used on this division, one at the head of the train and one pushing. The mountain section as a whole also fixes a limit to the capacity of the road on account of the slow speed necessitated by heavy traffic; it is impossible for steam locomotives to haul heavy trains on the mountain at a greater speed than seven or eight miles per hour.

The plant described herein is designed for use over the entire mountain division, by extending the system of conductors and building additional stations; it was not designed for the operation of the tunnel alone, although even if the problem had been the handling of the traffic through this tunnel and its approaches only, the three-phase system would in all probability have been selected, on account of its greater simplicity and less cost. The choice of the system to be used was under consideration for more than a year; the three-phase system was finally decided on.

The original problem was to provide equipment to handle a train having a total weight of 2,000 tons, excluding the electric locomotives, over the mountain division from Leavenworth to Skykomish, a distance of 57 miles. The system was to be first tried out at the Cascade tunnel.

The tractive effort required to accelerate a train having a total weight of 2,500 tons on a 2.2 per cent. grade, using 6 lbs. to the ton for train resistance and 10 lbs. to the ton for acceleration, making a total of 60 lbs. to the ton, is 150,000 lbs.; this would require four locomotives of a tractive effort of 37,500 lbs. each. The railway company's engineers limited the weight on a driving axle to 50,000 lbs.; therefore four driving axles per locomotive are needed, giving a coefficient of adhesion of about 19 per cent. This is a measure of the maximum power required. The locomotive was, therefore, designed to give a continuous tractive effort of approximately 25,000 lbs., and it was expected that four would be used with a train maximum weight. But the locomotive as built greatly exceeds this specification.

The principal data of the locomotive are as follows: Total weight 230,000 lbs., all on drivers; two trucks connected by a coupling, each truck having two driving axles; a three-phase motor connected by twin gears to each axle; gear-ratio, 4.26; diameter of driving wheels, 60 in.; synchronous speed of motor, 375 rev. per min., giving a speed of 15.7 miles per hour at no load, dropping to 15 miles per hour for a load

*Abstract of a paper presented to the American Institute of Electrical Engineers.

corresponding to the one-hour rating. The motors are wound for 500 volts and are completely enclosed and air-cooled; clearance between stator and rotor, ⅛ in.; trolley pressure, 6,000 volts; each locomotive has two three-phase transformers reducing the pressure from 6,000 to 500 volts, arranged with taps so that 625 volts may be used on the motor.

The distribution of the total weight of the locomotive is as follows:

2	trucks	81,500 lbs.
1	cab	30,000 "
4	motors	48,800 "
8	gears and gear cases	11,000 "
2	transformers	20,800 "
2	air compressors	5,800 "
1	blower	1,300 "
40	rheostats	10,200 "
56	contactors	3,200 "
	Miscellaneous	17,400 "
	Total	230,000 lbs.

That is,

Total weight per axle	57,500 lbs.
Dead weight per axle	18,500 "

The specification of the motor required an output of 250 h.p. continuously for three hours with 75 deg. cent. temperature elevation, when supplied with not more than 2,000 cu. ft. of air per minute. The test results of the motor show a continuous output of 375 h.p. at 500 volts with 1,500 cu. ft. and 400 h.p. at 625 volts, with the same air; the one-hour rating of the motor at 500 volts with 1,500 cu. ft. of air per minute is 475 h.p.; the ratio of continuous output to the hour-rating with 1,500 cu. ft. of air is therefore 79 per cent. The continuous output at 500 volts corresponds to a tractive effort of 9,350 lbs. per motor and the one-hour output to a tractive effort of 11,900 lbs. per motor; the locomotive will, therefore, give 37,400 lbs. tractive effort in continuous duty, or 47,600 lbs. tractive effort for one hour. Fig. 5 shows the characteristic curves of the motor at 500 volts.

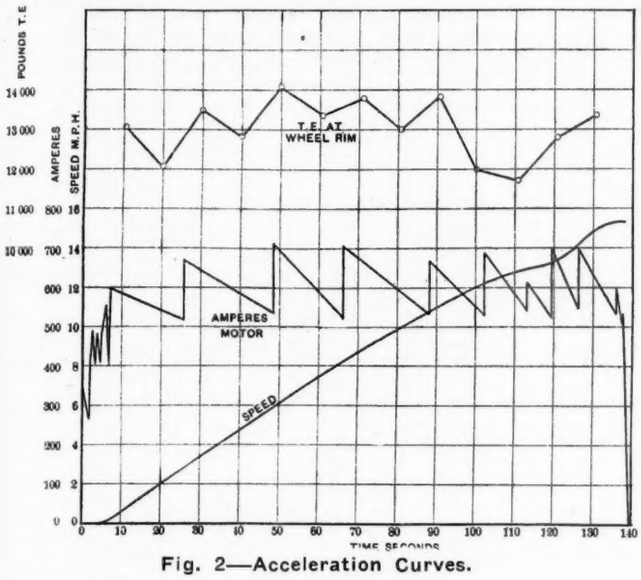


Fig. 2—Acceleration Curves.

Tractive effort for locomotive—52,000 lbs.
Acceleration—0.12 miles per hour per second.
Equivalent to a trailing load of 735 tons on a 2.2 per cent. grade.

Calculations from the profile of this section give:

Westbound, Leavenworth-Cascade.

Average up-grade	1.37 per cent.
Distance	32.4 miles.
Work per ton at the wheel rim	2.15 kw.-hr.
Average power per ton at the wheel at 15 miles per hour	1.00 kw.

Eastbound, Skykomish-Cascade.

Average up-grade	1.88 per cent.
Distance	24.8 miles
Work per ton at wheel rim	2.16 kw.-hr.
Average power for round trip per ton at wheel rim at 15 miles per hour	1.31 kw.
Average power per ton at wheel at 15 miles per hour for entire division	1.12 kw.
Maximum power per ton accelerating on 2.2 per cent. grade	1.8 kw.

These figures assume the train to be moving continuously and are based on 6 lbs. per ton train resistance, as are all calculations herein unless otherwise stated.

The average power of the locomotive when pulling will then be 1.12 k.w. per ton, and therefore each motor can carry 250 tons in continuous service on this mountain division, assuming there are no stops and no opportunity for cooling; or each locomotive could haul $(4 \times 250 - 115) = 885$ tons trailing load, if the power requirements were continuous; as there are necessarily stops, the rating as determined by heating is somewhat greater than this.

The locomotive has been tested to a maximum tractive effort of nearly 80,000 lbs., corresponding to a coefficient of adhesion of nearly 35 per cent.; with 60,000 lbs., or 26 per cent., each locomotive can accelerate the train of 885 tons trailing on a 2.2 per cent. grade, using 60 lbs. per ton as the total tractive effort; or, in other words, the train that a locomotive can haul, as determined by the average duty and safe heating limits, is just about equal to the train that it can accelerate on the maximum grade; that is, the average capacity of the locomotive and its maximum capacity are in the same proportion as the average duty and maximum duty. The design is well balanced.

Making some allowance for these figures for the sake of conservatism, the rating of the locomotive on this division can be put at 750 tons trailing load.

ELECTRIC EQUIPMENT OF LOCOMOTIVE.

Each locomotive is equipped with four three-phase induction motors, wound for 500 volts at the primate or stator; the motors are completely enclosed and are cooled by forced air circulation from a large blower. They are suspended from the axles in the standard manner, except that they are geared at both ends of the armature shaft; this was made necessary by the low speed and high torque required, as it was not considered safe to use a single pair of gears. The gear had 81 teeth, the pinion 19 teeth, giving a gear ratio of 4.26. The gears are of specially hardened steel; in order to secure perfect alinement the two pinions on each shaft were cut simultaneously. At first it was the intention to use some form of spring connection between motor and driving wheel, but this was subsequently abandoned, as it seemed that there would be sufficient flexibility in the armature shaft to take out any small differences between the two sets of gears. As far as can be told at present, this assumption appears through the resistances. There is a clear aisle on each side of the locomotive from end to end.

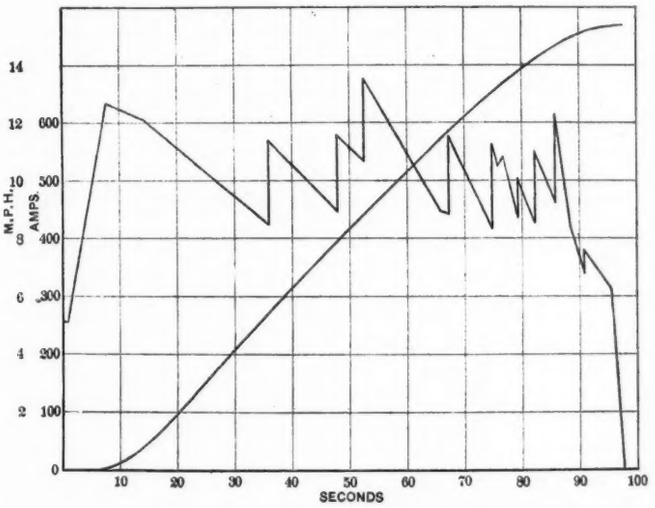


Fig. 3—Acceleration Curves.

Tractive effort for locomotive—44,400 lbs.
Acceleration—0.177 miles per hour per second.
Equivalent to a trailing load of 555 tons on a 2.2 per cent. grade.

Many acceleration tests were made at Schenectady, generally using one motor. Fig. 3 shows the result of one of these tests, in which the average tractive effort was 11,100 lbs. per motor, corresponding to 44,400 lbs. for the locomotive. Fig.

2 shows a similar test in which the average tractive effort was 13,000 lbs. per motor, corresponding to 52,000 lbs. for a locomotive. Fig. 3 is equivalent to accelerating a train of 555 tons on a 2.2 per cent. grade at the rate shown on the curve; that is, 0.177 miles per hr. per sec. Fig. 2 represents the acceleration of a train of 735 tons on a 2.2 per cent. grade at the rate there shown, that is, 0.12 miles per hr. per sec.

MECHANICAL DESIGN OF LOCOMOTIVE.

The locomotive is of the articulated or hinged type, having four driving wheels on each half of the running gear, and is without guiding wheels. The running gear is not

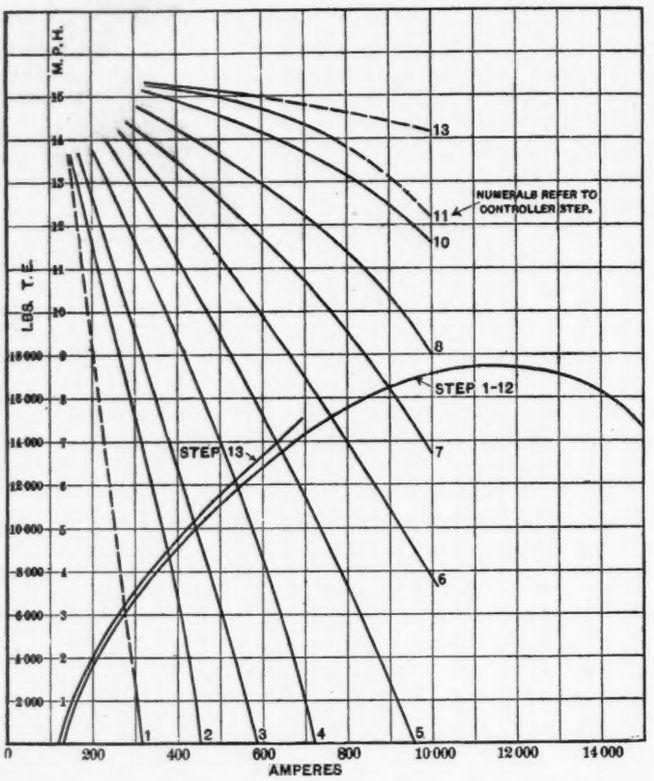


Fig. 4—Speed-Torque Curves of Great Northern Three-Phase Motor on the Various Control Steps.

two independent trucks coupled together, but is more nearly comparable to the Mallet type of steam locomotive, in that the hinged sections are so rigidly connected that they tend to support each other vertically and guide each other in taking the curves, although the hinges are designed to offer minimum resistance to lateral flexure. There are no springs to prevent this flexure, and the wheel base is free to accommodate itself to any curvature; the effect of this guiding action is to minimize the flange wear, as in the Mallet locomotive.

The equalization system takes advantage of the vertical rigidity of the truck to distribute the spring stresses over groups of springs instead of concentrating them on single springs; the truck section on the one end is side equalized, but the section on the other end is carried on a three-point suspension. The springs are thereby equalized in groups and the groups are so arranged as to eliminate all skew or twisting stresses in the truck frame.

The framing of the running gear is of substantial steel castings annealed and held together by body-bound taper bolts in reamed holes. Side-frames are castings of truss pattern; end-frames and bolsters are steel castings of box-girder type; the end-frames and all parts are designed for buffing stresses of 500,000 lbs. Bolsters are hollow castings and form part of the air reservoir for the motor ventilation; the air is supplied to the motors through a hollow center pin. The wheels are 60 in. in diameter with removable steel tires 3.5 in. thick. The wheel-centers are steel castings. The gears are shrunk on an extension of the wheel-hub, thus eliminating the torsional stresses from the locomotive-axles. The motors are connected through gears at both ends; that is, they are twin-geared to the driving wheels; this has the advantage of maintaining accurate alinement between axles and armature shaft.

The cab is carried on the trucks through center pins on each bolster, the center pin on one end having a slight longitudinal sliding motion to allow for variation in the distances between truck center-pins in taking curves. The cab extends the entire length of the platform and is made of No. 10 steel plates which carry a monitor that supports the trolley base and has a ventilated opening running through the center and perforated side plates to permit the escape of air from the interior of the cab. The greater part of the control apparatus, the rheostat, the transformers, contactors, etc., is placed in a separate compartment 60 in. wide and 22 ft. long, enclosed by steel partitions extending directly up to the monitor roof. This leaves two open operating spaces at the ends of the locomotive, connected together by two side aisles 30 in. in width. This center compartment is divided into three parts by steel-

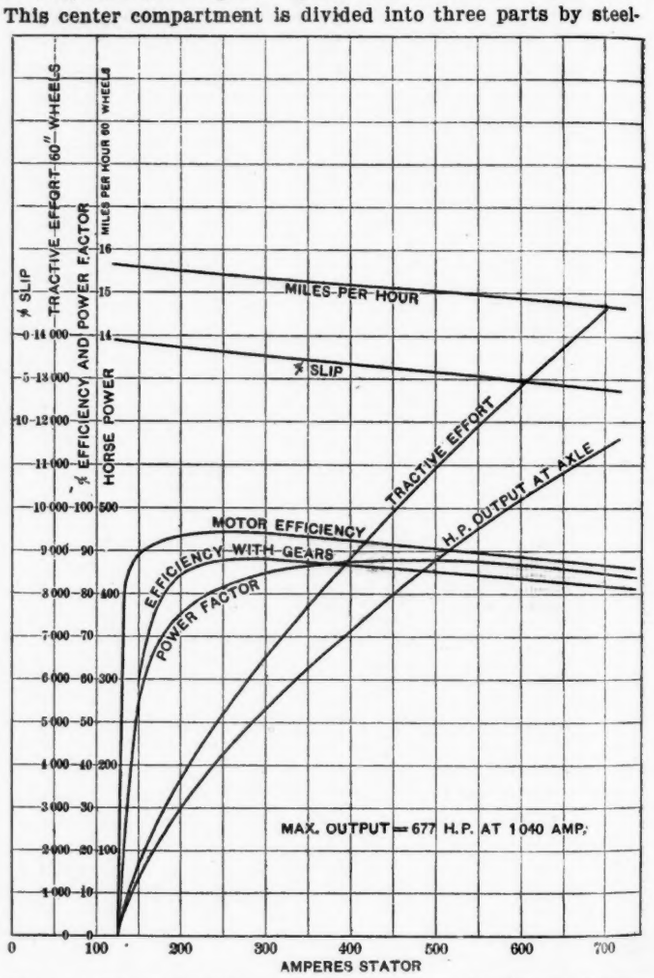


Fig. 5—Characteristic Curves of Great Northern Three-Phase 475-h.p. 25-cycle, 500-volt Motor—Gear Ratio 4.26; 60 in. Wheel.

plate partitions; the middle part contains the high-tension apparatus, including switchboard; the end parts are duplicates, each containing one transformer and the contactors for two of the motors. The rheostats are placed in the monitor at the top of the cab. The air for ventilation, after passing through the transformers, cools the rheostats and then escapes to the atmosphere. Placing these rheostats at the top of the cab has also the advantage of raising the center of gravity of the locomotive, which is nearly 60 in. above the rail head, higher than is usual with electric locomotives.

General News Section.

The Atchison, Topeka & Santa Fe is at the present drawing part of its tie supply from Japan. During the past year about 300,000 white oak ties have been bought in Japan for use on the lines west of Alberquerque.

Representatives of the Order of Railway Telegraphers say that their brotherhood is making persistent demands for increased pay on the Illinois Central, the Rock Island, the Chicago & North Western and the Chicago, Milwaukee & St. Paul.

The Canadian Pacific has this season sent out about a half million bulbs, mostly to station agents, who beautify the grounds around their stations. On the western part of the company's lines prizes are offered for the best-kept station gardens, after the fashion which is in vogue on the Boston & Maine.

President J. E. Sterret, of the American Association of Public Accountants, has again written a letter protesting against the unreasonable and impossible requirements of the federal corporation tax law, and it is said that the accountants' association will try to secure action by Congress this month amending the objectionable features of the law.

The Philadelphia Rapid Transit Company reports that on certain of its lines in that city since the introduction of "pay-within" street cars, the number of accidents to persons has decreased 74 per cent. This remarkable change is credited to the arrangement of closed doors and steps, making it impossible for passengers to get on or off when the cars are moving.

An arrangement has been made by the Chicago, Burlington & Quincy and the Chicago Great Western under which trains of the C. G. W. enter Kansas City over the Burlington's tracks from Beverly, Mo., instead of over the Kansas City Northwestern line southeast from Leavenworth, Kan. This reduces the Great Western's mileage between Kansas City and St. Joseph by nine miles and gives easier grades.

According to a press despatch from Seattle, a company of 40 boys recently seized a locomotive which had been sidetracked for the night by a construction crew near Birmingham, Wash., and every one of the 40 was injured, a few minutes later, when, because of their inability to stop it, they jumped off from the engine while it was running at considerable speed. Five of the boys were injured seriously. After the engine was deserted it ran at high speed to Birmingham yard and was wrecked in a collision with some freight cars.

The recent adjustment of differences between the New York, New Haven & Hartford Railroad and some of its clerks, includes, it is said, the recognition by the company of the Brotherhood of Railroad Clerks. The minimum rate of pay has been made $1.85 a day instead of $1.75; the contract is to run for a year; the regular work day is to be ten hours; promotion is to be by seniority; Sunday work is regulated; premiums on bonds are to be paid by the company, and there is a clause providing the right of appeal to the general manager, with compensation for time lost if the result of the appeal is favorable to the clerk.

James M. Reid, chief engineer of the National Railways of Mexico, is quoted as saying that it will cost $2,000,000 Mexican currency, to repair the enormous damage that was done to the lines of that system in the vicinity of Monterey and between Monterey and Saltillo by the floods of last August. This heavy outlay is additional to the cost of rebuilding about 60 miles of the Matamoros-Monterey line and a large part of the division between Monterey and Tampico. The roadbed between Monterey and Saltillo is being completely changed for one-half the distance, or more than 30 miles. The old line crossed and recrossed the Santa Catarina canyon down which the flood came, so that it was peculiarly vulnerable. The new roadbed is being built around the mountains and high up along the ledges of the canyon.

W. B. Storey, vice-president in charge of construction of the Atchison, Topeka & Santa Fe, has written a letter to H. H. Evans, secretary of the committee of the Chicago city council on local transportation, in which he makes six objections to the proposed ordinance requiring electrification of the Chicago terminals of the railways. After saying that smoke can be abolished by proper fuel and firing, Mr. Storey summarizes his objections to electrification as follows: "Electrification will not cure. Electricity is not now used in any freight terminal in America. The railways are unable to find anyone who will agree to install such an electric system or to say what it will cost. Electrification of railways only is an unjust discrimination. Electrification will be a detriment to the business and commerce of Chicago. The results sought can be obtained by other methods."

The Interstate Commerce Commission has received many petitions and letters from railway companies and from locomotive firemen asking for an extension of time for the equipment of locomotives with ashpans, to comply with the law of 1908, which goes into effect January 1, 1910. The commission, however, has no authority to change the date. Most of the principal roads have equipped a large share of their engines with pans which will comply with the law, and some few roads have equipped all their engines, but there are several thousand engines altogether which it seems likely will not be in condition to be used legally in interstate traffic after January 1. Some of the gossips say that Congress, which meets next week, will probably be asked to change the date from which the law must be enforced, but we do not hear of any definite action in this direction.

Earnings of the Pacific Coast Extension of the St. Paul.

The following figures, showing the earnings and expenses of the Chicago, Milwaukee & Puget Sound (operating 1,400 miles) for September and for the two months ended September 30, are the first detailed statement of the earnings of the St. Paul's Pacific coast extension:

	Sept., 1909.	Aug. 1-Sept. 30.
Freight revenue	$674,289	$1,280,685
Passenger revenue	86,869	167,143
Other transportation revenue	9,641	17,829
Non-transportation revenues	4,798	8,623
Total operating revenues	$775,599	$1,474,282
Maintenance of way and structures	20,750	46,543
Maintenance of equipment	42,187	71,647
Traffic expenses	22,473	405,390
Transportation expenses	211,536	40,037
General expenses	13,392	24,034
Total operating expenses	$310,340	$587,755
Net operating revenues	465,258	886,527
Outside operations (net)	4,359	8,468
Total net revenues	$469,618	$894,996
Taxes	20,000	40,000
Operating income	$449,618	$854,996

Protecting Forests from Fire.

James S. Whipple, forest, fish and game commissioner of the state of New York, reports that during the season which has just ended the total damage to forests in the state by fires has been $25,101, or an average of $1,618 to each county in the forest preserve, as against $40,249 average in each county last year. This year the number of acres burned was 11,967, mostly in old burnings, while last year 177,000 acres were burned. The new system of fire fighting has confined the burned area this year to an average of 47 acres per fire. The improvement is in getting at each fire when it starts. This year was not so dry as last, yet the fires burned later in the fall. The cost of protecting the forests this year has been $40,175, the principal items in this total being: Salaries of superintendents and patrolmen, $15,225; permanent telephone construction and mountain observation stations, $5,958; laborers and others actually fighting fire, $8,413. One-half of the last item is to be charged to the towns, and the expenses for telephones, tools,

etc., will not have to be repeated in future years. The fire superintendents and patrolmen have also assisted in enforcing the forest, fish and game laws generally.

Precautions for Handling Wrecks Involving Oil Cars.*

1. Action in any particular case will depend on circumstances, and good judgment will be necessary to avoid disastrous fires on the one hand and the useless sacrifice of valuable property on the other.

Volatile (or combustible) liquids, such as gasolene, naphtha, etc., in large quantity and spread over a large surface, will form vapors that may be ignited at a considerable distance, depending on the kind and quantity of liquid and the direction and force of the wind. Many of the liquids, regarded as safe to carry under ordinary conditions and transported in tank cars without the inflammable placard, should still be treated as dangerous in handling a wreck.

2. When oil cars are leaking all lights or fires near them that can possibly be dispensed with should be extinguished or removed. Incandescent electric lights, or portable electric flashlights, are safe.

Lanterns necessarily used for signaling should be kept on the windward side and at as high an elevation as can be obtained. The vapors will go with the wind. The ashpan and firebox of a locomotive or steam derrick, especially on the leeward side of a wrecked or leaking tank car, is a source of danger. Wrecks involving oil cars should in no case be approached with lighted pipes, cigars or cigarettes.

3. To prevent explosion of loaded tank cars that are not supplied with safety valves and are in danger of being subjected to heat from a fire, and that cannot be removed to a place of safety, the manholes should be opened, but only while subject to this danger. When manholes cannot be opened, or, on account of position of the car, valves are inoperative, ventage should be secured by puncturing in the tank four or five small holes near the top, in any convenient way, to secure ventage equal to that of a hole 3 in. in diameter.

4. Effort should be made to prevent the spread of oil over a large surface by collecting it in any available vessels or draining it into a hole or depression at a safe distance from the track. When necessary, trenches should be dug for this purpose.

It is not safe to drain inflammable oil in large quantity into a sewer, since vapors may thus be carried to distant points and there ignited. Care should also be exercised, on account of possible claims for damages, not to permit oil to drain into streams of water used by irrigation plants or for watering stock. Dry earth spread over spilled oil will decrease the rate of evaporation and the danger. A stream of oil on the ground should be dammed, and dry earth thrown on the liquid as it collects.

5. Sudden shocks or jars that might produce sparks or friction should be avoided. When possible, jack the wrecked cars carefully into position, after removing other cars and freight that might be injured by fire. Only as a last resort should the wreck be cleared by dragging, and when this is done all persons should be kept at a safe distance.

6. No unnecessary attempt should be made to transport an injured tank car from which inflammable liquid is leaking. If wrecked, or derailed, and not in a position to obstruct or endanger traffic, it should have its leak stopped as far as possible, and left under guard until another tank car, or sufficient vessels, can be provided for the transfer of the liquid, which should be transferred by pumping when practicable.

7. An empty, or partially empty, oil car, with or without placards, is very liable to contain explosive gases, and lights must not be brought near it.

8. *Water will not quench an oil fire.* If the fire cannot be smothered by use of earth or wet blankets, effort should be concentrated on confining it and saving other property.

9. Should a leak occur by the breaking or displacing of the unloading valve and pipe at the bottom of the car, it can be frequently stopped by removing the dome cap on top of the tank and dropping the plunger into the plunger seat, as a shock sufficient to injure the outlet valve and pipes may have also unseated the plunger.

*Suggested by the Committee of the American Railway Association.

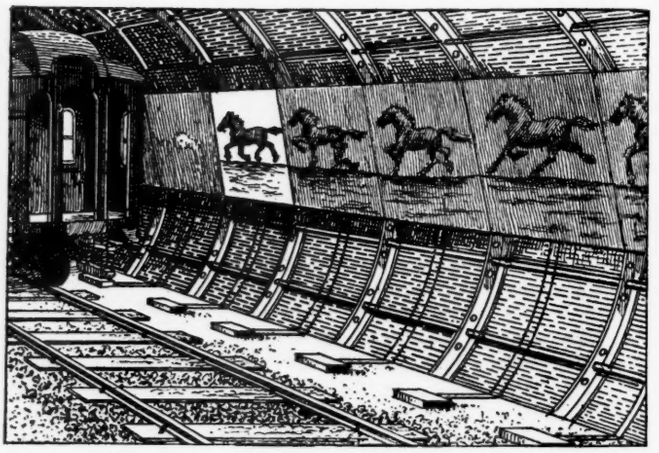
Not Confirmed—Menu Later.

An innovation in electric railway transportation is about to be tried on an interurban road running from Portland, Ore., to Salem, the state capital, and other Willamette valley points. This is the serving of a free lunch on the interurban trains at meal time. The inauguration of a regular dining car service would be cumbersome and mean hauling an additional heavy car, but by putting on a buffet-observation car lunch can be served with little inconvenience.

Porters on the cars will serve the lunch without charge and "it is believed the new service will prove very popular." Regular charges will be made for observation car seats but this toll will include the luncheon, so the passenger will have the unique experience of getting something for nothing from a railway company. * * *—*Exchange.*

The Subway Beautiful.

Moving pictures are produced, as is well known, by a film traveling with intermittent motion before a projector or lantern which throws successive views on the screen. The same result could be obtained if the pictures were stationary and the audience itself were in motion, so as to view the pictures successively. An ingenious inventor has hit upon this scheme to relieve the monotony of subway travel. He proposes to mount a continuous band of pictures at each side of the subway, and have these pictures successively illuminated, by means of lamps placed behind them. The circuits of the lamps would be successively closed, by means of a shoe upon the subway car engaging contact plates at each side of the track. The accompanying illustration indicates the method of accomplishing this result.—*Scientific American.*



Artificial Live Scenery for Subways.

Profit Sharing by a "Trust."

George W. Perkins, of the firm of J. P. Morgan & Co., New York, and chairman of the finance committee of the International Harvester Company, speaking at the recent meeting of the National Civic Federation, in New York, said that the plans of the Harvester Company for sharing a percentage of its profits with its employees were more extensive and more liberal than any ever before adopted. At the same time the company is actuated by business considerations, and does not give this money to the employees out of pure philanthropy. Thus far the company has every reason to congratulate itself on the result, the interest of the employees in the business having been appreciably increased. Continuing, Mr. Perkins said: No American workman wants something for nothing. Either profit sharing is profitable to both employer and employee or it is profitable to neither and cannot succeed. No plan involving the secret, perhaps unconscious, purpose to benefit the business in question out of proportion to the benefit accruing to the labor employed can succeed permanently, for the selfish motives underlying are bound to work to the surface. It is of the utmost importance to American business

interests of to-day and to-morrow that every man in any given concern be so associated with that concern that he will give the best there is in him to the performance of the duties assigned to him.

Over 4,000 employees now enjoy the benefit of the profit-sharing scheme. A certain sum is set aside by the company yearly, based on the profits, and payments are made to workmen who have made a satisfactory showing during the year. Employees in the sales department also have the benefit of a similar scheme. The company has allotted 27,500 shares of its stock for sale to the employees below the market value, and to purchasers who have been in the service five years or more certain bonuses are allowed.

The Employees' Benefit Association embraces over 75 per cent. of the persons working in the Harvester Company's factory. The contributions are 2 per cent. of the employees' salary. The company contributes $50,000 a year toward the expenses. Over 21,000 employees are now contributing members. The company pays pensions to retired employees, on a plan similar to that in use on the Pennsylvania Railroad; and it takes particular care to protect employees against injury and against damage to their health.

August Belmont, chairman of the board of directors of the Interborough Rapid Transit Company, spoke before the Federation concerning the relief department on his road. There are now 5,297 members, which is equal to 56 per cent. of all the employees of the company.

Strike of Switchmen in the Northwest.

Press despatches from St. Paul, November 30, report that all of the switchmen belonging to the Switchmen's Union of North America, employed on the 13 railways west and north of St. Paul and Duluth, went on strike at 6 p. m. of that day. The leaders in the strike say that 2,300 men are involved. A committee of the 13 companies centering in the twin cities, had held conferences with leaders of the union for 15 days. The railway officers' committee issued a statement, saying:

The switchmen made simultaneous demands on thirteen companies. At the suggestion of F. T. Hawley, president of the Switchmen's Union of North America, of whose organization the switchmen in the Northwest are members, arrangements were made to conduct the negotiations in one conference.

The demands of the switchmen were for double pay for Sundays, holidays and overtime; an advance of 60 cents a day of ten hours in the wages of switchmen, switch tenders, towermen, engine herders and assistant yard masters; a modification of the rule providing for the payment of penalty in case of failure to permit switchmen to secure their meal in the middle of their shift at a stated period, which contemplates double pay in cases where it became necessary to work a portion of the meal hour; and the elimination of the physical examination and the age limit placed upon switchmen entering the service.

The managers' committee offered the switchmen an increase of 20 cents a day of ten hours in the rates of pay of switchmen employed in the territory west of Havre, Mont., on the Great Northern Railway, and west of Billings, Mont., on the Northern Pacific Railway; the differential in that territory for switchmen having obtained for about two years.

Further concession was declined for the reason that the rates of pay of switchmen were increased over 13 per cent. in November, 1906, and because the rates at that time established had not been reduced during the period of business depression which followed.

The attention of the switchmen was called to the fact that in 1906 the switchmen were granted a larger percentage of increase than any other class of employees in train service. At the present rates the wages of the switchmen average over $100 a month.

In submitting its final answer to the switchmen the managers suggested that the demands be submitted to arbitration under the provisions of the Erdman act. The switchmen declined this suggestion and in a written answer that "the committee begs leave to state that it will not submit to arbitration under any circumstances."

Martin A. Knapp, of the Interstate Commerce Commission, and Charles P. Neill, United States Commissioner of Labor, were asked [by the railways] to act as mediators under the Erdman act.

Before the conferences with Messrs. Knapp and Neill had begun, despite the understanding reached in the conferences, that mediation under the Erdman act should be evoked, and without the knowledge of either the managers' committee or mediators, a strike order was issued by the switchmen's committee directing the switchmen of the thirteen Northwestern railways to cease work at 6 p. m., November 30, in the event that their full demands had not been conceded.

This violation of good faith so embarrassed the negotiations that successful mediation became impossible and led to the demand by Messrs. Knapp and Neill, addressed to both the managers' committee and the switchmen, that the controversy be submitted to arbitration under the terms of the Erdman act. To this proposal the managers' committee gave its willing assent, but the switchmen absolutely declined it.

Speaking for the switchmen, Mr. Hawley said:

The switchmen have been fair in their requests. The request for double pay for overtime is in the nature of a penalty more than anything else, as we want to discourage overtime, Sunday and holiday work. We also ask for a modification of the physical requirements and age limit rules. Examinations for employment on railways now are as rigid as those required for service in the regular army. * * * We did not wish a strike, and used every reasonable means to avoid one. We have advised every member that from the moment the strike begins he must keep away from the company's property and obey the law. * * *

Improvements on the Missouri Pacific in Kansas.

On November 19 W. R. Stubbs, governor of Kansas, sent a telegram to George J. Gould, stating that for two years the Kansas Railway Commission had been urging the Missouri Pacific to improve its roadbed in Kansas and furnish better service; and that while some progress had been made there are several hundred miles of the road in Kansas "where the roadbed and the service are a shame and a disgrace." The governor called attention particularly to the Central branch, running from Atchison to Lenora, which, he said, "is a conspicuous example of a railway traversing the richest farming community in the world where the service and tracks are bad beyond comparison." He asked Mr. Gould to advise him immediately and definitely what improvements he proposed to make on this branch and when he proposed to make them. On November 22 Mr. Gould replied by wire to Mr. Stubbs that the Missouri Pacific had had under careful preparation for a year a comprehensive financial plan, not only for providing funds to meet present requirements but those of future years. He continued: "It has been a very difficult and arduous undertaking to work out with leading banking interests and has been very recently concluded. In the meantime, however, we have proceeded with all the resources available from the company's income during a period of business depression to improve the physical condition of our Kansas lines. The successful conclusion of our financing enables us to commence and push as rapidly as possible improvements on the Central branch as well as our other lines on a much more liberal scale, and these improvements will be continued uninterruptedly, weather permitting, until the needs of the public are met."

On November 24, acting under instructions from Mr. Gould, C. S. Clarke, vice-president of the Missouri Pacific, conferred with Governor Stubbs at Topeka, and the newspaper reports say that the governor agreed to refrain from making his intended application for a receiver if the company would promise to spend $750,000 on the Central branch in 1910 and lay 100 miles of new 80-lb. rails and 140 miles of rock ballast. E. C. Shiner, secretary of the Kansas Railway Commission, has made public the following letter from Vice-President Clarke, telling of improvements that have been made or that are proposed in Kansas:

"This company has recently completed or authorized new station buildings as follows: Milton, Altoona, Sherwin, Axtell, Dexter, Goffs, Soldiers Home, Richland, Kansas City, Kan., Yates Center, Brown's Spur, Buff City, together with

extensive improvements in existing depots at Beloit and Fredonia.

"A radical improvement of the condition of the company's lines in Kansas was undertaken in 1907 and since that time there have been the following amounts for the items shown:

"Drainage, $169,856; bank widening, $457,547; ballast, $367,537; new rail, $972,000; tie renewals, $1,831,365; total, $3,798,305.

"Exclusive of the station facilities these improvements have been made on the lines over which the heaviest traffic passes, but the improvement work will be continued until all of the company's lines in Kansas are in a satisfactory condition.

"In the order which has been placed for 85-lb. rail to be delivered in 1910 there is included 100 miles for the Central branch. The ballasting of the Central branch will also be seasonably resumed in 1910. In the meantime no expense will be spared to improve the present condition by the work of surfacing the tracks, and we confidently believe that the causes for complaint will be greatly diminished, if not entirely eliminated."

Mr. Shiner stated also that plans of the Missouri Pacific include reconstruction of the main line, for which a contract has been let to the L. J. Smith Construction Company, and that this company is now employing 20 locomotives on this work. In addition, the railway, with its own equipment and forces, is reballasting its line from Coffeyville northeast for 68 miles; from Coffeyville to Yates Center, a distance of 70 miles; from Coffeyville to Conway Springs, 135 miles; and from Yates Center to Eldorado and on the McPherson branch, 130 miles.

City Railway Proposals in Brooklyn.

The Brooklyn Rapid Transit Company, operating the elevated and most of the surface street railways in Brooklyn, N. Y., has made up the following program, which, it is said, will be laid before the State Public Service Commission:

1. To equip and operate the Fourth avenue subway.
2. To extend its Fifth avenue elevated line as an elevated road to Fort Hamilton.
3. To elevate its West End line from Coney Island to Eighteenth avenue, and to depress the tracks from that point north to Forty-third street, where they will run into the Fourth avenue subway.
4. To elevate its Sea Beach road from Coney Island to the point where it joins the West End line.
5. To elevate its Culver Line for its entire length.
6. To extend its Brighton Beach division, as already announced, by subway to Flatbush avenue and Fulton street, and thence via the Fourth avenue subway, the Manhattan Bridge and the Canal street subway to Manhattan, to a loop at the North River.
7. To third track its Fulton street line.
8. To third track its Lexington avenue line.
9. To third track its Broadway line.
10. To make various extensions to its elevated system in the Eastern District with a view to furnishing the East New York and Ridgewood sections with a much better transportation service than now exists.

The expense of these improvements, with the exception of the short stretch of subway from Prospect Park down Flatbush avenue to the Fourth avenue subway, will be borne by the Rapid Transit company. For the use of the subway system projected the company would pay rental on the basis of the amount of traffic. After deducting the interest on the $50,000,000 bonds invested and the cost of operation the company would pay all revenue increase after the first year of operation to the city and stockholders.

The Progress of Refrigeration Transportation.

E. O. McCormick, of the Union and Southern Pacific, chairman of the American Section of the International Commission on Railway and Steamship Refrigeration, and E. F. McPike, of the Illinois Central, secretary of the American section, have issued a circular, stating that in the common interests of American transportation companies, shippers and receivers of perishable products, the American Section intends to keep in close touch with the improvement and progress of refrigeration transportation throughout the world from a technical as well as from a practical standpoint. Continuing the circular says:

"The American Section will also encourage the making of special researches and the preparation of articles relating to the present status or possible improvement of various phases of refrigerator transportation in America. Suggestions and recommendations along these lines, from any source, will be welcomed."

Derailment in British Columbia; 20 Killed.

According to a press despatch of November 28 a work train on the Great Northern Railway was on that day derailed at a culvert, which had been washed out by a flood, and the car next behind the engine, occupied by 35 Japanese laborers, most of them asleep, was wrecked, and 20 of the men were killed. All of the other 15 were injured. The engine passed nearly over the weakened culvert and then fell back, crushing the car occupied by the workmen.

An Unlimited Train with Limited Stops.

Chairman Mayfield of the Texas state railway commission, has made a report on his inspection of the passenger service on the Rio Grande & Eagle Pass Railroad. He recommends that the road be required to purchase one first-class passenger coach and one combination coach by January 1, and that thereafter the road maintain regular passenger service. The earnings of the road are found to be healthy, having the traffic of three coal mines. It is recommended that it commence within ten days to operate a mixed train that will not stop more than thirty minutes at any point between the termini of the road. The train now leaves Minera at 11 a. m. and reaches Laredo, 26 miles, at 5 p. m., or an average of less than 4½ miles an hour, which would be a fairly good gait for an ordinary foot passenger to walk the distance, says the chairman's report.

The Commission—"I Can't See How I'm Ever Goin' to Amount to Anything Like This."

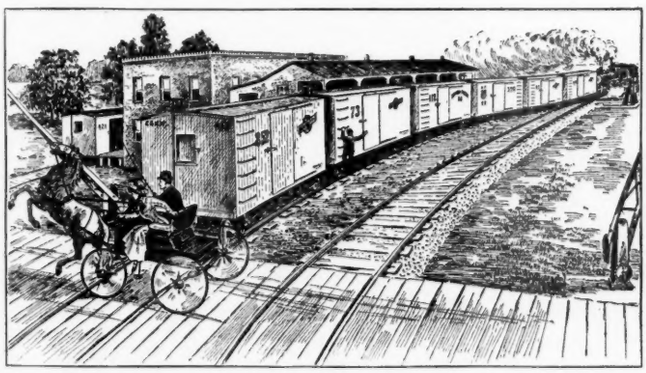
—Des Moines Register and Leader.

Folly of Physical Valuation of Railroads.

The folly of going to the vast expense of a physical valuation of all railway properties, such valuation to be used as a basis for rates to be charged, is ably set forth by Roswell Miller, chairman of the board of the Chicago, Milwaukee & St. Paul Railway, in *Harper's Weekly*. He cites the findings of the railway commissions of Minnesota and of Washington showing the present physical value of various northwestern roads to be far in excess of their capitalization. If we should go to all the trouble and expense of a physical valuation we should find that we had arrived nowhere. We will have given jobs to many more political job-hunters, but we should know then as we do now that rates must be on a uniform basis with the different roads, even if one has cost twice as much as another to build. These noisy reformers, who skim around on the surface of things seldom illuminate a subject, but rather add to confusion of thought.—*The Commercial West.*

Pictorial Admonition.

The accompanying illustration of a man, a woman, a horse and buggy in a dangerous position is copied, on a reduced scale, from one published in the *Northwestern Bulletin*. The officers of the Chicago & North Western have decided to endeavor to educate their employees in carefulness by the use of pictorial lessons, and this is the first one that has appeared. The statement accompanying the picture says:



"Here are at least three men, one at the switch target, one riding on the cars, and one in charge of the crossing gates, each supposed to be intent upon his business but each in fact neglecting to do his full duty. The gates have not been properly closed, the train conductor has not placed a man at the crossing, the brakeman has his back turned to it, the man at the switch target is paying no attention to it, and the engineer very naturally assumes that these men have looked after that feature before giving him the signal to move."

The second pictorial lesson, published in the November issue of the *Bulletin*, shows the typical old lady, with a basket, stepping off a passenger car without assistance, while a trainman standing near her is looking the other way. In the same scene a woman with two children and two pieces of baggage is being neglected by another trainman. The woman herself carries a good-sized suit case, while her little boy is lugging a big "telescope"; and the little girl has dropped her mama's handbag. The neglectful brakemen are so elegantly dressed that the uninformed observer might take them for Pullman employees. Of course, it cannot be that the *Northwestern* in this official way intends to cast any slur on the Pullman men! As to the picture which we reproduce we can only say that we have reduced it a trifle too much, thus doing some injustice to the beauty of the woman, the indifference of the man at the switch and the furious energy with which the engine is working.

A State Railway After Election.

In the Canadian Parliament at Ottawa, in a recent discussion on the affairs of the Intercolonial Railway, it was stated that 503 employees had recently been dismissed.

Locomotive Fuel Economy—Condensed.

The United States Geological Survey has issued a report of the series of locomotive fuel tests made for it by Professor W. F. M. Goss, in which Mr. Goss' conclusions are summarized as follows: Ninety million tons of coal, one-fifth of the total production of the country, was consumed by the 51,000 locomotives in the United States in one year (1906). This fuel cost the railway companies $170,500,000. Of this total 10,080,000 tons are lost through the heat in the gases that are discharged from the stacks of the locomotives; 8,640,000 tons are lost through cinders and sparks; 5,040,000 tons are lost through radiation, leakage of steam and water; 2,880,000 tons through unconsumed fuel in the ashes, and 720,000 tons through the incomplete combustion of gases. In addition, 18,000,000 tons are consumed in starting fires, in moving the locomotive to its train, in backing trains into or out of sidings and in keeping the locomotive hot while standing.

Under ideal conditions of operation much of the fuel thus used could be saved, and it is reasonable to expect that the normal process of evolution in railway practice will tend gradually to bring about some reduction in the consumption thus accounted for. The loss represented by the heat of discharged gases offers an attractive field to those who would improve the efficiency of the boiler. The fuel loss in the form of cinders passing out of the stack is very large and may readily be reduced. A sure road to improvement in this direction lies in an increased grate area. Opportunities for incidental saving are to be found in improved flame ways such as are to be procured by the application of brick arches and other devices. Such losses may also be reduced by greater care in the selection of fuel and in the preparation of the fuel for the service in which it is used. It is not unreasonable to expect that the entire loss covered by this item will in time be overcome. The fuel which is lost by dropping through grates and mingling with the ashes is a factor that depends on the grate design, on the characteristics of the fuel, but chiefly on the degree of care exercised in managing the fire. More skillful firing would save much of the fuel thus accounted for.

Lumber Production in 1908.

According to a bulletin issued by the Forest Service, the total valuation of the lumber, lath and shingle production of the United States in 1908 reached $541,545,640, this being a decrease of 23 per cent. from the previous year's output. The number of mills reporting was 31,231, and those manufactured 33,224,369,000 board feet of lumber, valued at $510,575,822, and 2,986,684,000 lath, valued at $6,791,328, while the shingle-makers turned out 12,106,483,000 shingles, valued at $24,178,490. The average value of lumber at the point of manufacture was $15.37 a thousand feet, $2.27 a thousand for lath and $2 a thousand for shingles.

Yellow pine of the South, which has been far in the lead in the lumber production for more than a decade, more than maintained its supremacy last year, contributing slightly more than 33 per cent. of the total cut from all kinds. Douglas fir of the Northwest ranked second and white pine third. For these three kinds of timber there was a falling off of 15, 22 and 20 per cent., respectively. Oak and hemlock maintained their relative rank, but showed decreases of 25 per cent. each in amount produced, and spruce dropped 18 per cent.

Louisiana was the heaviest producer of yellow pine lumber, supplying nearly one-fifth of the total production. Texas, Mississippi, Arkansas and Alabama followed in the order named. The state of Washington alone supplied more than three-fifths of the Douglas fir cut, while the bulk of the remainder came from Oregon. Minnesota produced about a third of the white pine, followed by Wisconsin, with about 15 per cent., and New Hampshire with 10 per cent. Maine and Massachusetts together produced more white pine than Michigan, which for many years led the country in producing this valuable timber.

Oak lumber manufacture now centers in Kentucky, West Virginia and Tennessee. Wisconsin comes first in the production of hemlock, taking the position held by Pennsylvania for many years.

Canadian Society of Civil Engineers.

A meeting of the general section was held on December 2. A paper on Construction of Lethbridge Viaduct, Crow's Nest Branch, Canadian Pacific Railway, by C. N. Monsarrat, M. Can. Soc. C. E., was read by the author and illustrated by lantern slides.

American Society of Civil Engineers.

At the meeting held on December 1, a paper by James H. Brace and Francis Mason, members American Society of Civil Engineers, entitled The New York Tunnel Extension of the Pennsylvania Railroad: The Cross-Town Tunnels, was presented for discussion. This was printed in *Proceedings*, October, 1909, and introductory papers by Charles W. Raymond, and Alfred Noble, members, American Society of Civil Engineers, were published in *Proceedings* for September, 1909.

MEETINGS AND CONVENTIONS.

The following list gives names of secretaries, dates of next or regular meetings, and places of meeting.

Air Brake Association.—F. M. Nellis, 53 State St., Boston, Mass.; May 10-13; Indianapolis.
American Association of Demurrage Officers.—A. G. Thomason, Scranton, Pa. June, 1910; Niagara Falls, Ont.
American Assoc. of Local Freight Agents' Ass'ns.—G. W. Dennison, Penna. Co., Toledo, Ohio.
American Institute of Electrical Engineers.—R. W. Pope, 33 West 39th St., New York; second Friday in month; New York.
American Railway Association.—W. F. Allen, 24 Park Place, New York; May 18; New York.
American Railway Bridge and Building Association.—S. F. Patterson, B. & M., Concord, N. H.
American Railway Engineering and Maint. of Way Assoc.—E. H. Fritch, Monadnock Bldg., Chicago, March 14-17, 1910; Chicago.
American Railway Industrial Association.—G. L. Stewart, St. L. S. W. Ry., St. Louis; second Tuesday, May; Memphis, Tenn.
American Railway Master Mechanics' Association.—J. W. Taylor, Old Colony Building, Chicago; June 20-22; Atlantic City.
American Society for Testing Materials.—Prof. Edgar Marburg, Univ. of Pa., Philadelphia.
American Society of Civil Engineers.—C. W. Hunt, 220 W. 57th St., N. Y.; 1st and 3d Wed., except July and August; New York.
American Society of Mechanical Engineers.—Calvin W. Rice, 29 W. 39th St., N. Y.; 2d Tues. in month; annual, Dec. 7-10; New York.
American Street and Interurban Railway Association.—B. V. Swenson, 29 W. 39th St., New York.
Association of Am. Ry. Accounting Officers.—C. G. Phillips, 143 Dearborn St., Chicago; June 29, 1910; Colorado Springs.
Association of Railway Claim Agents.—E. H. Hemus, A., T. & S. F. Topeka, Kan.; May; Nashville, Tenn.
Association of Railway Telegraph Superintendents.—P. W. Drew, Wisconsin Central Ry., Chicago. May 16-20, 1910; Los Angeles.
Association of Transportation and Car Accounting Officers.—G. P. Conard, 24 Park Place, N. Y. Dec. 14-15; Chattanooga.
Canadian Railway Club.—James Powell, Grand Trunk Ry., Montreal, Que.; 1st Tues. in month, except June, July and Aug.; Montreal.
Canadian Society of Civil Engineers.—Clement H. McLeod, Montreal, Que.; irregular, usually weekly; Montreal.
Central Railway Club.—H. D. Vought, 95 Liberty St., New York; 2d Friday in January, March, May, Sept. and Nov.; Buffalo.
Freight Claim Association.—Warren P. Taylor, Rich., Fred. & Pot. R. R. Richmond, Va. June 15, 1910, California.
International Master Boiler Makers' Association.—Harry D. Vought, 95 Liberty St., New York.
International Railway Fuel Association.—D. B. Sebastian, La Salle St. Station, Chicago; May; Chicago.
International Railway General Foremen's Association.—L. H. Bryan, D. & I. R. Ry., Two Harbors, Minn.; May; Cincinnati.
Iowa Railway Club.—W. B. Harrison, Union Station, Des Moines, Ia.; 2d Friday in month, except July and August; Des Moines.
Master Car Builders' Association.—J. W. Taylor, Old Colony Bldg., Chicago; June 15-17; Atlantic City.
New England Railroad Club.—G. H. Frazier, 10 Oliver St., Boston, Mass.; 2d Tues. in month, ex. June, July, Aug. and Sept.; Boston.
New York Railroad Club.—H. D. Vought, 95 Liberty St., New York; 3d Friday in month, except June, July and August; New York.
North-West Railway Club.—T. W. Flanagan, Soo Line, Minn.; 1st Tues. after 2d Mon., ex. June, July, August; St. Paul and Minn.
Railway Club of Pittsburgh.—J. D. Conway, Pittsburgh, Pa.; 4th Friday in month, except June, July and August; Pittsburgh.
Railway Signal Association.—C. C. Rosenberg, 12 North Linden St., Bethlehem, Pa.
Railway Storekeepers' Association.—J. P. Murphy, Box C, Collinwood, Ohio; May 16-18; St. Louis.
Roadmasters' and Maintenance of Way Association.—Walter E. Emery, P. & P. U. Ry., Peoria, Ill.
St. Louis Railway Club.—B. W. Frauenthal, Union Station, St. Louis, Mo.; 2d Friday in month, except June, July and Aug.; St. Louis.
Society of Railway Financial Officers.—C. Norquist, Chicago.
Southern Association of Car Service Officers.—J. H. O'Donnell, Bogalusa, La.
Southern and Southwestern Ry. Club.—A. J. Merrill, Prudential Bldg., Atlanta; 3d Thurs., Jan., April, Aug. and Nov.; Atlanta.
Traveling Engineers' Association.—W. O. Thompson, N. Y. C. & H. R. R. R., East Buffalo, N. Y.
Western Canada Railway Club.—W. H. Rosevear, 199 Chestnut St., Winnipeg; 2d Mon., ex. June, July and Aug.; Winnipeg.
Western Railway Club.—J. W. Taylor, Old Colony Bldg., Chicago; 3d Tuesday each month, except June, July and August; Chicago.
Western Society of Engineers.—J. H. Warder, Monadnock Bldg., Chicago; 1st Wednesday, except July and August; Chicago.

Traffic News.

The Potomac & Chesapeake Steamship Co., of Virginia, announces its intention of establishing, about January 1, a freight steamship line between New York and Washington.

At the invitation of the Merchants' Association of New York delegates from the boards of trade and other commercial bodies of a large number of eastern cities met in New York City last week and decided to establish a joint traffic bureau to manage the affairs of these different associations in dealing with the railways concerning freight rates.

F. N. Judson, a prominent lawyer of St. Louis and author of "Judson on Interstate Commerce," has been employed by the attorney-general of Oklahoma to represent the state in the litigation in the federal court over freight and passenger rates. Frank Hagerman, who represented the railways in the Missouri rate cases, will also represent them in the Oklahoma cases.

The Delaware, Lackawanna & Western announces reductions in freight rates on sugar from New York westward, to go into effect January 3, which, it is said, are designed to meet the reduction of 4 cents recently made by the Illinois Central in rates on sugar from New Orleans to points in the territory of the Central Freight Association. The other lines from New York will probably make similar reductions.

The Western railways, through the Western Passenger Association, have informed the Chicago Association of Commerce and the commercial associations of other cities that after January 1, 1910, reduced rates will not be granted for merchants' meetings or for any other purposes except probable colonists and homeseekers' and summer tourists' excursions. This action is the result of a decision reached by the executive officers of the various roads.

Notice has been sent out by the Trunk Line Association roads to the effect that on westbound export freight from the Atlantic seaboard rates are to be put back to the normal basis, which was in force last January, an announcement which is taken to mean that the Boston & Maine has won its contention; that the rates from Boston will be the same as from Baltimore, and that from Philadelphia they will be one or two cents higher. Something is said about a future conference to settle the controversy, but the matter seems to be in the same uncertain condition that has characterized it for the past 10 months. Some of the merchants of Philadelphia are protesting loudly at the "back down" by the Pennsylvania Railroad.

The California Metal Trades Association has asked the transcontinental lines to establish a differential between the rates on fabricated and unfabricated steel materials from Missouri river points and east thereof to the Pacific coast. The present rate on fabricated material is $4.50 and a lower rate than this is asked on unfabricated material. One of the chief arguments advanced is that foreign merchant iron has recently been shipped from Europe to the Pacific coast at a rate of $1.95 per ton. The usual rate on steel and iron products from Europe to the Pacific coast is from $3.50 to $5 per ton, but these rates are often reduced to nominal figures. The exportation of wheat from California, Washington and Oregon to Europe is very large and as the tonnage of return traffic is very light the steamships will make almost any rate to get return lading.

The Railway Commission, the railways and the lumber producers of Texas are wrestling with the question of fixing lower rates on Texas lumber, which, it is claimed, are needed to enable the Texas lumbermen to compete in the markets of their own state with lumber from Louisiana. The Texas law requires that before a road may receive a division of a through rate it must be recognized as a common carrier, and to be recognized as a common carrier it must be equipped with automatic couplers and be operated in accordance with requirements of the state laws, to meet which, it is claimed, would impose an expense on the owners of logging railways which they cannot afford to incur. There are about 600 sawmills in Texas which operate logging roads which thus can get no share in through freight rates. In Louisiana, however, it is easy for a railway to get itself recognized as a

common carrier and thus be entitled to divisions. Almost every big lumber producing concern in Louisiana which operates a logging road receives divisions of the through rate, amounting to from 2 cents to 7 cents per 100 lbs. The Texas commission and the Texas lumbermen and railways held a conference November 27 but no agreement was reached. The commission has set another hearing for December 14, and probably will order a reduction in rates on lumber shipped from Texas producing points to Texas consuming points of 5 cents per 100 lbs. The railways no doubt will strongly oppose this reduction.

Wabash Encourages Study of Agriculture.

The Wabash has adopted a plan for encouraging the study of scientific agriculture along its lines. The company's lines run through 18 counties in Missouri, and it will give a prize of $50 to the student from each of these counties who makes the best record in the seven weeks' course in agriculture at the University of Missouri at Columbia, which will begin on January 4 and end February 25. The prizes distributed will aggregate $900. The counties whose prize students will be thus rewarded include the richest agricultural part of the state. The course includes instruction "in corn judging, breeding and growing; in soil fertility, farm crops and farm buildings; in live stock judging, stock breeding, animal breeding, stock farm management, in breeding, feeding and handling dairy cows, in making butter and cheese, and handling of milk products, in diseases of farm animals and their treatment, in growing, handling and selling orchards, in agricultural chemistry, agricultural botany, and injurious insects; in carpentry and blacksmithing and in poultry husbandry."

Special instructors and additional equipment have been provided for the coming term. More than 60 teachers give instruction in the department of agriculture and 37 teachers and investigators devote themselves exclusively to its work. The college claims to own the best herd of dairy cattle to be found in any agricultural school in the world. There are only 17 Jersey cows in existence that have produced more than 700 lbs. of butter in one year, and five of these were bred and developed here. In 1907 students of the Missouri school made the highest score in judging cattle at the live stock exposition in Chicago, and this year they won the $500 cup at the Royal live stock show at Kansas City, Mo., in judging cattle in competition with students from the state universities of Iowa, Kansas and Nebraska. Experiments conducted at the college have increased the corn yield in the southwestern part of the state from 20 bush. to 45 bush. per acre, and its wheat yield 15 bush. per acre. The dean of the school, Prof. F. B. Mumford, will determine to whom the prizes given by the Wabash shall be awarded.

New York Traffic Club.

The annual meeting of this club was held at the Hotel Astor on the evening of November 30. The following officers were elected for the ensuing year: President, Charles F. Moore, editor *Freight;* vice-presidents, F. E. Herriman, I. Isselhardt, George O. Somers, F. E. Stoddard, H. C. Burnett; treasurer, F. C. Earle, traffic manager, Manhattan Navigation Co.; secretary, C. A. Swope, eastern freight agent Louisville & Nashville; assistant secretary, H. L. Derby, traffic manager the Casein Manufacturing Co.

Heavy Traffic in New York Interborough Subway.

The New York state Public Service Commission, First district, has issued a statement showing that on Friday, Nov. 26, the day after Thanksgiving, the single line of Interborough Subway carried more passengers in its 24 hours of operation than did all four lines of the elevated roads. The record of the Subway for the day was 866,000 passengers, as against 865,000 for the elevated lines. This was a new high-water mark for the Subway, the previous record being 861,000 passengers on the Monday preceding Christmas a year ago. The daily average of the Subway in the year ended June 30, 1909, was 648,000, as against 375,000, which was the maximum capacity calculated for the Subway as originally built (minus the Brooklyn extension).

Reports to the Public Service Commission show that the Interborough is now running 12 side-door trains of eight cars each, and that the company is now a train or two ahead of the orders of the commission, and is turning out side-door cars at something better than 16 a month. It is expected that the rate will be increased to 25 a month in the near future, and the company has ordered 250 new cars of this type. This, with the proposed lengthening of the Subway platforms, so as to accommodate express trains of 10 cars each, will, it is expected, increase the capacity of the present Subway in the neighborhood of 30 per cent.

Traffic Club of St. Louis.

The annual meeting and dinner of the Traffic Club of St. Louis were held on November 29. The following officers were elected: President—George J. Tansey, St. Louis Transfer Co. Vice-presidents—C. R. Gray, St. Louis & San Francisco; George W. Simmons, Simmons Hardware Co.; E. F. Kearney, Missouri Pacific; P. W. Coyle, Freight Bureau of the Business Men's League; George E. Howard, Commonwealth Steel Co. Secretary-treasurer—A. F. Versen, Freight Bureau of the Business Men's League. Directors—John E. Massengale, St. Louis & Tennessee River Packet Co.; J. D. McNamara, Wabash; Wm. Gray, Chicago, Burlington & Quincy; O. H. Greene, National Lead Co.; E. E. Scharff, Nicholas Scharff & Sons Grocer Co.

George W. Simmons, the retiring president of the club, acted as toastmaster, and addresses were made as follows: "The Railroads," by George E. Chamberlain; "The Railway Business Association," by George A. Post, president of the Standard Coupler Company and of the Railway Business Association; "The Relation Between Corporate Enterprises and the Public," by F. C. Dillard, interstate commerce attorney Harriman Lines.

Revenues and Expenses of Express Companies.

The following table shows the revenues and expenses of 13 express companies for the first six months of 1909. The classification is that prescribed by the Interstate Commerce Commission and may need a word of explanation. The primary accounts under revenue are: express revenue, non-transportation revenue and express privileges—debt. The accounts under expenses are: maintenance, traffic, transportation and general.

Express revenues include all receipts from the carriage of goods by express, but does not include profits from the money order department and similar departments. This money order revenue and other banking revenue is credited to non-transportation revenue. It will be observed that instead of treating the rental paid to railways for the privilege of operating on their lines as an expense, this sum is treated as a debit item under revenue.

The expense of maintenance combines both maintenance of way and structures and maintenance of equipment. The maintenance of cars is divided into accounts for repairs, renewals and depreciation, but in the account for maintenance of horses there is no allowance made for depreciation. Traffic expenses are much the same as those for railways, while transportation expenses represent the cost of actually handling the business, exclusive of rental paid to railways for the privilege of operating on their lines. This transportation account includes the wages of drivers, feed of horses, pay of agents, etc.

If we add together the debit for express privileges and total operating expenses and find what proportion this sum is of total receipts from operation, we will get a figure that we may call operating ratio. The total receipts from operation for the first six months of 1909 of the Adams Express Co. was $14,052,033, and total operating expenses and cost of express privileges was $13,306,715. The operating ratio was therefore 94.7 per cent. For Wells-Fargo & Co. total receipts from operation for the six months were $12,282,112, and total operating expenses and express privileges cost $10,748,768, so that the Wells-Fargo operating ratio was 87.5 per cent.

There is a sharp decrease shown in the table in the total mileage operated (rail lines) between April and May for the United States Express Co., and a sharp increase in total mileage operated (rail lines) between April and May for Wells-Fargo & Co. While there is a considerable drop in the receipts from operation in May in the case of the United States Express Co., there is apparently no corresponding increase in receipts from operation in the case of Wells-Fargo & Co.

MONTHLY REPORTS OF REVENUES AND EXPENSES OF EXPRESS COMPANIES.

Six months of 1909.	Express revenue.	Non-transportation revenue.	Total receipts from operation.	Express privileges, Dr.	Total operating revenues.	Maintenance.	Traffic expenses.	Transportation expenses.	General expenses.	Total operating expenses.	Net operating revenue (or deficit).	One-twelfth of annual taxes.	Operating income (or loss).	Miles of line operated Rail.	Miles of line operated Other.
ADAMS EXPRESS COMPANY:															
January	$2,077,435	$11,381	$2,088,816	$1,052,559	$1,036,258	$22,933	$2,640	$899,685	$69,487	$994,746	$41,512	$12,077	$29,435	31,702	3,407
February	2,016,272	11,553	2,027,825	1,063,874	963,951	32,896	3,257	859,606	67,478	963,238	713	12,270	11,557†	31,902	3,407
March	2,482,516	13,335	2,495,851	1,288,549	1,207,301	40,088	3,324	916,635	64,658	1,024,705	182,596	13,263	169,333	31,829	3,387
April	2,545,275	14,114	2,559,389	1,335,044	1,224,345	39,142	3,235	911,089	70,071	1,023,538	200,807	15,411	185,397	31,592	3,466
May	2,447,730	14,416	2,462,146	1,280,921	1,181,225	37,775	4,842	898,802	66,592	1,008,011	173,214	14,676	158,538	30,899	3,460
June	2,416,133	1,873	2,418,006	1,256,458	1,161,547	38,154	3,955	901,325	71,637	1,015,071	146,476	16,629	129,847	30,872	3,488
AMERICAN EXPRESS COMPANY:															
January	2,081,886	71,759	2,153,645	983,691	1,169,954	28,127	16,537	1,083,671	115,866	1,244,202	74,248*	1,258	75,506†	45,780	1,253
February	2,085,025	74,023	2,159,049	955,174	1,173,874	16,129	14,570	1,057,432	103,823	1,191,955	18,081*	739	18,819†	45,946	1,253
March	2,617,064	85,924	2,702,898	1,236,563	1,466,426	41,653	15,097	1,081,273	103,159	1,241,182	225,244	46,460	178,784	45,919	1,011
April	2,802,314	103,095	2,905,409	1,324,093	1,581,316	24,402	16,588	1,135,908	104,876	1,281,773	299,542	9,173	290,370	46,017	1,316
May	2,722,000	96,712	2,818,712	1,308,999	1,509,712	40,305	15,084	1,104,440	119,244	1,279,073	230,640	21,513	209,127	45,999	1,917
June	2,625,675	135,727	2,761,402	1,298,705	1,462,697	190,688	17,831	813,735	1,511	1,023,765	438,932	105,528	333,405	46,024	2,100
CANADIAN EXPRESS COMPANY:															
January	136,076	4,322	140,398	71,283	69,115	4,586	1,695	57,790	9,652	73,723	4,608	1,150	5,758	6,308	2,792
February	129,196	3,159	132,355	65,863	66,492	1,135	1,164	58,948	7,139	68,387	1,895*	1,150	3,045†	6,308	2,792
March	165,427	3,908	169,330	84,215	85,088	2,351	1,126	62,007	6,652	72,135	12,952	1,150	11,803	6,520	2,792
April	180,240	.....	184,369	90,696	93,673	966	1,228	65,348	6,122	73,665	20,009	1,150	18,859	6,520	2,792
May	177,762	4,670	182,433	90,481	91,952	1,853	1,019	63,781	6,625	63,278	18,674	1,150	17,524	6,520	2,792
June	199,069	4,278	203,347	99,972	103,375	1,988	1,056	69,401	7,290	79,734	23,641	1,150	22,491	6,520	2,792
GLOBE EXPRESS COMPANY:															
January	59,537	556	60,093	20,834	39,259	79	895	12,939	2,506	16,420	22,839	300	22,539	1,894	....
February	55,349	541	55,889	19,018	36,871	202	875	12,562	2,430	16,069	20,801	300	20,501	1,894	....
March	66,152	592	66,744	23,776	42,967	97	982	13,026	2,491	16,596	26,371	300	26,071	1,894	....
April	54,729	521	55,249	24,585	30,664	458	1,063	12,929	2,510	16,960	13,704	300	13,404	1,894	....
May	59,480	511	59,991	26,359	33,632	578	983	12,968	2,668	17,197	16,435	300	16,135	1,894	....
June	73,718	1,269	74,987	30,062	44,925	648	1,108	13,340	2,440	17,536	27,390	385	27,005	1,900	....
GREAT NORTHERN EXPRESS COMPANY:															
January	128,830	991	129,821	52,167	77,653	1,249	688	44,856	3,075	49,868	27,786	2,931	24,855	7,033	211
February	135,160	994	136,155	54,767	81,387	680	644	39,295	3,103	43,722	37,665	1,955	35,710	7,033	211
March	167,124	1,212	168,336	67,798	100,538	1,336	782	41,134	3,446	46,699	53,840	1,910	51,930	7,033	211
April	161,218	1,085	162,303	65,351	96,952	1,233	710	42,728	3,173	47,843	49,109	2,500	46,609	7,033	211
May	187,279	1,063	188,342	75,942	112,401	1,283	1,324	44,252	3,846	50,706	61,695	2,457	59,238	7,156	211
June	204,153	1,165	205,318	122,946	82,372	5,693	915	45,297	3,108	55,013	27,359	2,624	24,735	7,201	211
NATIONAL EXPRESS COMPANY:															
January	67,819	345	68,164	25,398	42,766	2,325	8	42,662	2,755	47,750	4,984*	12	4,996†	1,030	.....
February	67,129	328	67,467	25,139	42,328	829	8	39,772	2,631	43,241	913*	198	1,111†	1,030	.....
March	87,930	335	88,264	32,930	55,335	656	8	42,179	2,627	45,470	9,865	642	9,223	1,030	292
April	90,206	391	90,597	33,782	56,815	645	.....	43,583	3,076	47,304	9,511	4	9,507	1,030	292
May	92,575	312	92,887	35,985	56,902	774	.....	42,998	2,772	46,523	10,378	84	10,295	1,030	292
June	105,325	473	105,798	43,988	61,810	3,876	.....	45,718	2,932	52,526	9,284	10	9,274	1,030	292
NORTHERN EXPRESS COMPANY:															
January	183,766	3,334	187,100	91,218	95,882	1,003	787	59,196	4,279	65,266	30,616	3,500	27,116	6,299	261
February	197,654	4,197	201,852	99,981	101,871	905	1,395	57,272	4,385	63,957	37,914	3,500	34,414	6,299	261
March	241,002	4,085	245,088	119,460	125,628	2,164	706	59,471	4,388	66,729	58,899	3,500	55,399	6,299	261
April	256,233	4,164	260,397	124,439	135,959	672	802	62,945	4,852	69,272	66,687	3,500	63,187	6,299	261
May	278,470	4,387	282,857	138,623	144,234	2,251	866	64,038	4,189	71,344	72,889	3,500	69,389	6,445	261
June	319,015	4,774	323,788	168,560	155,229	3,613	998	71,662	5,241	81,513	73,716	2,208	71,508	6,497	261
PACIFIC EXPRESS COMPANY:															
January	515,181	8,426	523,607	273,843	249,764	6,970	5,819	196,518	12,687	221,995	27,769	4,789	22,980	21,812	608
February	531,678	8,056	539,734	291,944	247,790	10,036	6,244	197,523	12,950	226,753	21,037	4,789	16,247	21,859	608
March	655,324	9,916	665,240	332,747	332,493	7,315	5,996	197,433	12,911	223,656	108,837	4,789	104,048	21,931	608
April	662,853	10,353	673,206	321,823	351,383	10,290	6,135	197,930	13,827	228,182	123,201	4,789	118,412	21,959	608
May	646,375	10,162	956,537	317,717	338,819	12,495	5,915	200,377	12,954	231,742	107,078	4,789	102,288	22,021	608
June	633,217	3,617	637,133	1,112,643	475,509*	11,854	5,907	203,323	13,459	235,044	710,553*	6,692	717,245†	22,064	608
SOUTHERN EXPRESS COMPANY:															
January	995,288	11,367	1,006,819	494,624	512,195	7,007	5,023	344,431	46,143	402,604	109,591	8,516	101,075	31,405	3,075
February	993,426	12,974	1,006,400	488,233	518,167	8,174	5,609	340,918	43,703	398,405	119,762	8,781	110,981	31,037	3,075
March	1,194,941	14,334	1,209,277	590,171	619,105	19,811	5,196	355,819	45,502	426,328	192,778	9,219	183,558	31,044	3,075
April	1,266,041	12,042	1,278,151	639,065	639,086	20,421	6,102	366,635	43,921	437,079	202,007	9,422	192,586	31,043	3,075
May	1,038,717	9,121	1,048,838	518,467	530,371	9,814	5,254	343,287	45,988	404,344	126,027	9,499	116,528	30,520	3,075
June	936,937	8,040	944,976	450,384	484,592	11,622	5,389	334,047	41,932	392,985	91,607	9,229	82,378	30,512	3,075
UNITED STATES EXPRESS COMPANY:															
January	1,187,208	18,183	1,205,391	573,336	632,055	13,991	7,828	622,539	44,952	689,310	57,256*	8,578	65,834†	29,939	455
February	1,159,262	17,481	1,176,743	561,501	615,241	32,705	7,169	596,539	43,806	680,219	64,978*	10,063	75,040†	30,010	455
March	1,417,358	22,896	1,440,254	694,925	745,330	.....	7,382	617,980	45,318	666,959	78,370	18,974	59,396	30,031	455
April	1,523,247	21,873	1,545,120	715,409	829,711	47,548	8,224	626,920	49,993	732,665	97,046	9,932	87,114	30,080	455
May	1,240,443	18,122	1,258,565	581,975	676,590	30,160	7,999	579,726	42,180	660,066	16,524	9,761	6,763	22,688	455
June	1,246,295	37,562	1,283,857	559,439	724,419	48,015	7,862	509,390	46,429	611,695	112,723	4,544	108,180	23,888	611
WELLS FARGO & Co.:															
January	1,552,110	36,646	1,588,756	760,540	828,216	19,101	10,080	640,110	54,937	724,228	103,988	6,985	97,003	49,903	5,702
February	1,591,393	37,984	1,629,376	749,312	880,065	25,430	12,724	640,472	53,970	732,596	147,469	11,624	135,845	49,976	1,293
March	2,047,155	44,495	2,091,649	965,125	1,126,524	66,285	12,629	679,880	58,469	817,262	309,262	11,549	297,713	50,072	5,684
April	2,110,932	38,501	2,149,433	1,025,310	1,124,123	48,117	13,425	693,200	52,878	807,620	316,504	16,531	299,973	50,483	5,634
May	2,437,880	40,908	2,478,788	1,137,540	1,341,248	92,839	24,389	822,184	55,383	994,795	346,454	16,624	329,830	60,370	4,989
June	2,303,059	41,051	2,344,110	1,110,458	1,233,653	38,658	14,371	812,921	58,986	923,986	309,666	24,142	285,525	60,756	4,942

*Deficit. † Loss.

Miscellaneous transportation revenue: Canadian Express Company—April, $4,129; Southern Express Company—January $164, March $1, April $69, May $1,000.

REVENUES AND EXPENSES OF RAILWAYS.

MONTH OF SEPTEMBER, 1909.
(See also issues of November 5, 12, 19 and 26.)

Name of road.	Mileage operated at end of period.	Operating revenues			Operating expenses						Net operating revenues (or deficit).	Outside operations. net.	Taxes.	Operating income (or loss).	Increase (or dec.) comp. with last year.
					Maintenance										
		Freight.	Passenger.	Total, inc. misc.	Way and structures.	Of equipment.	Traffic.	Transportation.	General.	Total.					
Arizona & New Mexico	108	$71,190	$8,035	$80,903	$6,730	$5,001	$63	$11,731	$1,965	$25,490	$55,413	.....	$875	$54,538	$23,324
Astoria & Columbia River	122	22,593	49,051	75,506	9,257	3,266	1,021	21,369	2,021	36,894	38,572	$1,554	2,300	37,826	9,013
Atlanta & Birmingham Air Line	237	60,172	23,231	88,579	15,713	7,179	989	30,895	1,114	55,890	32,689	.....	4,833	27,856	431
Atlanta & West Point	93	45,669	35,394	88,665	13,537	17,253	5,372	26,755	4,979	67,897	20,768	—35	3,836	16,897	—3,407
Atlantic & St. Lawrence	167	54,169	33,185	96,288	89,821	9,486	2,588	21,066	1,848	124,809	—28,521	.....	6,436	—34,956	—44,052
Butte, Anaconda & Pacific	46	84,402	8,682	98,474	9,195	20,424	496	37,869	4,498	72,482	25,992	.....	2,000	23,992	—12,016
Carolina, Clinchfield & Ohio	211*	73,430	13,041	88,980	11,289	12,676	4,301	20,570	5,539	54,375	34,605	.....	2,500	32,105	30,839
Chicago, Milwaukee & Puget Sound	1,400†	674,290	86,870	775,599	20,750	42,187	22,474	211,537	13,392	310,340	465,259	4,359	20,000	449,618	.....
Cincinnati & Muskingum Valley	148	70,386	19,934	95,226	16,119	12,800	2,234	30,160	1,535	62,848	32,378	.....	3,000	29,378	10,482
Denver, Northwestern & Pacific	214‡	41,868	43,251	89,377	18,263	9,038	2,890	26,697	4,662	61,550	27,827	.....	2,500	25,327	1,852
Eastern Ry. of New Mexico	227	34,775	32,646	72,284	23,127	8,061	836	22,369	2,287	56,680	15,604	.....	3,480	12,124	—20,573
Fort Smith & Western	221	48,732	18,677	70,758	18,152	12,272	1,143	16,136	2,725	50,428	20,330	.....	4,200	16,130	24,370
Fort Worth & Rio Grande	196	41,464	24,676	71,691	11,843	10,203	3,026	30,462	3,078	58,612	13,079	.....	1,476	11,603	1,728
Georgia R. R	307	187,781	66,396	267,449	30,954	29,490	10,038	98,047	7,084	175,613	91,836	.....	1,768	90,068	34,796
Gila Valley, Globe & Northern	125	66,305	11,284	82,964	29,471	6,175	725	17,665	1,742	55,778	27,186	.....	1,900	25,286	—13,111
Houston East & West Texas	191	74,067	27,591	107,196	18,351	8,329	1,307	32,735	3,489	64,211	42,985	.....	—477	43,463	4,438
Indianapolis Southern	179	62,301	22,140	89,700	22,670	10,645	1,076	30,201	1,211	65,803	23,897	.....	3,733	20,164	—252
International & Great Northern	1,159	627,045	161,996	833,799	122,629	133,150	17,992	288,007	20,532	582,310	251,489	.....	22,000	229,489	378
Lehigh & New England	170	75,038	1,300	77,086	12,512	7,223	1,036	19,140	3,081	42,992	34,094	.....	850	33,244	9,288
Mineral Range	126	67,492	4,868	74,965	13,787	11,405	1,142	31,880	1,183	59,397	15,568	.....	3,200	12,368	—375
Missouri & North Arkansas	365§	41,586	21,403	66,908	20,843	8,953	1,500	22,727	1,998	56,021	10,887	.....	3,900	6,987	10,001
Monongahela R. R	65	111,625	2,236	115,560	19,280	8,127	220	22,483	1,520	51,630	63,930	.....	1,150	62,780	26,655
Monongahela Connecting	7	70,781	.....	83,344	11,567	10,411	300	36,209	2,515	61,002	22,342	.....	1,455	20,887	18,520
Pittsburg, Shawmut & Northern	240	85,900	11,677	99,415	14,530	30,126	1,259	29,161	3,347	78,423	20,992	.....	1,587	19,405	33,874
Quincy, Omaha & Kansas City	262	44,491	23,701	74,110	42,748	12,920	1,404	29,600	2,902	89,574	—15,464	.....	2,450	—17,914	—27,295
St. Louis, Brownsville & Mexico	456	55,136	30,366	91,644	31,487	9,321	2,706	32,382	5,908	81,805	9,840	.....	3,600	6,240	—15,127
St. Louis, San Francisco & Texas	132	56,455	12,924	73,136	16,034	15,003	2,727	36,192	3,770	73,726	—590	.....	462	—1,052	—3,176
Spokane International	141	47,027	25,793	74,910	11,382	3,498	1,845	21,394	2,353	40,472	34,438	.....	2,294	32,144	3,762
Syracuse, Binghamton & New York	81	46,211	41,973	97,661	4,730	6,361	2,980	27,796	1,966	43,833	53,828	.....	5,635	48,193	3,036
Texas Central	268	35,227	27,895	69,797	21,987	12,045	1,326	27,006	2,988	65,352	4,445	.....	2,963	1,482	—15,652
Texas Midland	125	55,174	10,484	69,038	9,624	9,249	1,131	20,503	2,819	43,326	25,712	.....	1,200	24,512	10,674
Ulster & Delaware	129	58,622	36,914	99,939	16,933	10,457	1,051	39,967	2,551	70,959	28,980	65	3,200	25,845	3,920
Wabash-Pittsburgh Terminal	63	60,949	8,530	72,130	7,630	8,336	2,777	22,073	4,754	45,570	26,560	.....	5,700	20,860	—5,252
Washington Southern	35	27,966	26,391	70,756	7,480	8,965	945	26,185	2,026	45,601	25,155	.....	2,345	22,810	5,424
Western Ry. of Alabama	133	52,878	34,319	94,772	16,366	17,405	5,503	24,472	6,004	69,750	25,022	—436	4,453	20,133	—3,274
Wichita Valley	203‖	32,232	20,971	55,834	8,746	2,510	362	18,758	1,614	31,990	23,844	.....	1,732	22,112	6,023
THREE MONTHS OF FISCAL YEAR 1910.															
Arizona & New Mexico	108	208,475	21,015	236,174	19,806	12,807	181	34,385	5,006	72,185	163,989	.....	2,625	161,364	15,914
Astoria & Columbia River	122	71,161	160,126	243,303	36,821	11,794	3,911	60,934	6,432	119,892	123,411	5,491	6,900	122,002	21,363
Atlanta & Birmingham Air Line	237	163,526	72,322	250,851	42,754	19,479	2,750	88,992	4,303	158,278	92,573	.....	14,500	78,073	18,097
Atlanta & West Point	93	123,490	111,347	255,576	36,424	50,407	15,254	77,498	12,315	191,898	64,078	—78	11,508	52,492	24,556
Atlantic & St. Lawrence	167	156,224	109,947	293,620	155,615	31,649	8,453	75,037	8,383	279,137	14,483	.....	19,307	—4,824	—55,118
Butte, Anaconda & Pacific	46	255,011	37,261	308,515	33,964	58,693	1,358	114,634	7,906	216,555	91,960	.....	6,000	85,960	—26,775
Carolina, Clinchfield & Ohio	211*	173,032	39,903	219,033	32,017	37,009	11,051	47,386	15,692	143,155	75,878	.....	7,500	68,378	68,396
Chicago, Milwaukee & Puget Sound	1,400†	1,280,685	167,143	1,474,282	46,544	71,621	40,138	405,391	24,035	587,755	886,527	8,469	40,000	854,996	.....
Cincinnati & Muskingum Valley	148	179,352	60,856	255,209	47,764	34,257	5,214	81,075	4,019	172,329	82,880	.....	9,400	73,480	13,660
Denver, Northwestern & Pacific	214‡	115,852	188,127	316,233	50,605	26,572	11,675	75,181	14,362	178,395	137,838	.....	7,500	130,338	20,393
Eastern Ry. of New Mexico	227	139,494	107,320	261,913	56,392	26,787	2,681	68,859	7,390	161,809	100,104	.....	10,442	89,662	—26,283
Fort Smith & Western	221	110,448	58,230	178,260	51,084	41,869	3,405	50,437	7,290	154,085	24,175	.....	12,600	11,575	30,996
Fort Worth & Rio Grande	196	94,517	80,383	191,097	35,292	28,452	9,441	81,436	10,019	164,640	26,457	.....	4,681	21,776	—3,253
Georgia R. R	307	453,078	204,074	695,392	105,698	98,199	28,006	279,735	21,437	533,075	162,317	.....	5,337	156,982	83,738
Gila Valley, Globe & Northern	125	195,703	36,746	246,959	76,378	20,447	2,867	57,723	5,583	162,998	83,961	.....	5,700	78,261	—18,582
Houston East & West Texas	191	204,098	87,268	308,180	48,710	24,170	4,318	95,160	10,107	182,465	125,715	.....	9,139	116,576	9,367
Indianapolis Southern	179	167,225	65,476	246,214	63,532	34,661	3,813	87,813	3,632	193,451	52,763	.....	11,200	41,563	—7,889
International & Great Northern	1,159	1,400,090	496,404	2,024,781	403,655	336,849	53,722	795,654	60,458	1,650,338	374,443	.....	62,000	312,443	—20,072
Lehigh & New England	170	222,530	3,786	228,229	38,523	22,956	2,971	56,232	8,738	129,420	98,809	.....	2,550	96,259	21,401
Mineral Range	126	202,970	13,800	224,931	42,452	54,119	2,717	98,049	5,303	182,640	42,291	.....	9,600	32,691	—3,323
Missouri & North Arkansas	365§	107,907	66,751	185,990	51,353	22,180	5,009	61,016	6,133	145,691	40,299	.....	11,700	28,599	31,365
Monongahela R. R	65	307,228	6,599	318,991	49,302	21,214	773	62,387	4,861	138,537	180,454	.....	3,500	176,954	76,063
Monongahela Connecting	7	214,144	.....	247,766	28,665	28,976	915	101,353	7,629	167,538	80,228	.....	4,365	75,863	76,320
Pittsburg, Shawmut & Northern	240	235,447	34,275	274,537	40,429	78,911	3,382	84,478	9,251	216,451	58,086	.....	4,746	53,340	78,901
Quincy, Omaha & Kansas City	262	132,240	66,622	215,209	112,411	38,281	4,173	89,856	8,265	252,986	—37,777	.....	7,350	—45,127	—60,344
St. Louis, Brownsville & Mexico	456	174,305	102,612	298,378	87,484	25,890	7,536	113,072	17,653	251,635	46,743	.....	10,800	35,943	—19,621
St. Louis, San Francisco & Texas	132	164,535	36,298	211,334	43,344	39,882	7,691	100,712	9,991	201,620	9,714	.....	1,628	8,086	—147
Spokane International	141	134,756	77,168	218,455	30,948	13,189	5,851	63,449	7,982	121,419	97,036	.....	6,545	90,491	28,656
Syracuse, Binghamton & New York	81	129,020	115,352	274,469	17,935	17,999	9,164	76,202	6,726	128,026	146,443	.....	14,135	132,308	12,807
Texas Central	268	103,978	101,990	225,471	66 674	41,391	4,302	78,494	10,902	201,763	23,708	.....	8,998	14,710	—41,494
Texas Midland	125	108,977	31,562	150,923	26,877	27,122	3,720	52,068	8,277	118,064	32,859	.....	3,600	29,259	25,021
Ulster & Delaware	129	185,148	185,296	386,368	47,293	30,290	4,949	132,139	7,320	221,991	164,377	95	9,600	154,872	27,005
Wabash-Pittsburgh Terminal	63	173,801	25,404	206,308	18,993	24,194	7,389	64,476	13,965	129,017	77,291	.....	17,100	60,191	—38,584
Washington Southern	35	98,287	78,949	231,766	23,570	24,899	3,111	80,050	6,168	137,798	93,968	.....	7,034	86,934	25,026
Western Ry. of Alabama	133	141,945	104,053	267,134	47,936	52,885	15,649	72,607	14,553	203,630	63,504	—1,278	13,359	48,867	224
Wichita Valley	203‖	88,135	61,365	156,740	25,792	8,791	818	53,042	4,873	93,316	63,424	.....	5,196	58,228	—3,839

*Mileage operated Sept. 30, 1908: 107 miles.
†Began regular operation Aug. 1, 1909.
‡Mileage operated Sept. 30, 1908: 185 miles.
§Mileage operated Sept. 30, 1908: 201 miles.
‖Mileage operated Sept. 30, 1908: 174 miles.
— Indicates deficits, losses, decreases and reverse entries.

INTERSTATE COMMERCE COMMISSION.

The Interstate Commerce Commission has postponed from January 1, 1910, to April 1, 1910, its order in what is known as the Peavey elevator cases. This order prohibited the railways from making an allowance to certain companies for elevating wheat.

Commissioner Cockrell, of the Interstate Commerce Commission, has given an informal opinion to a passenger officer of a western road that when a limited ticket is lost by a passenger or destroyed before being used, it is not unlawful for the carrier, after the limit of the ticket has expired, to make a refund to the passenger, provided the loss or destruction of the ticket and the identity of the holder are clearly and definitely proved in a form that becomes a part of the record of the case, the record also to show that the ticket was not used by any person.

STATE COMMISSIONS.

The board of railway commissioners of Maine has dismissed the complaint of the Portage Lake Mill Co. against the Bangor & Aroostook. According to a Portland daily paper, this is the first case of the kind ever decided by the Maine commission. The commission holds that a railway company has a right to make lower rates to a point where it has to meet competition from other railways and from railways operating in Canada than it makes to Portage Lake, 50 miles further away.

The Railway Commission of Louisiana after rehearing on November 23 decided that the differentials fixed by it on November 2 between the rates on rice in carload and less-than-carload quantities were not sufficient to meet the demands of commerce. It has, therefore, issued an order fixing a differential between carload and less-than-carload rates of 6 cents. The carload rates vary from 5½ cents per 100 lbs. for distances of 10 miles and under to 14 cents for distances over 125 miles, and the less-than-carload rates vary from 11½ cents for 10 miles and under to 20 cents for distances over 125 miles. The minimum carload weight is fixed at 30,000 lbs. On shipments moving over more than one road the joint through rate will be the sum of the mileage rates of the different roads less 10 per cent., with a maximum of 17 cents for carload and 24 cents for less-than-carload shipments. The maximum rates to Monroe, La., must not exceed 14 cents on carloads and 24 cents on less-than-carloads.

J. E. Love, chairman of the Oklahoma Corporation Commission, has issued a statement in which he controverts the testimony given by railway officers in the cases that are pending in federal court, in which the roads attack the validity of the 2-cent fare provision of the Oklahoma constitution and orders that have been issued by the Corporation Commission reducing freight rates. He says that a great majority of prominent railway executives are "'woolies' who have been chosen to high offices as a rule on account of their financial ability rather than on account of their special knowledge of railroading," and that they "are grossly incompetent when it comes to judging the earning power of the properties under their immediate management, a part of such properties being located in Oklahoma." The statistics filed with the commission showing results of operation in 1907, the last year of the territorial government in Oklahoma, and in 1909, he says, demonstrate the truth of his charge. He gives the following figures:

	On the "Katy."	On the Gulf, Colorado & Santa Fe.
No. passengers carried one mile:		
1909, entire line	113,347	91,687
1909, State of Oklahoma	135,513	187,680
1907, entire line	90,169	81,500
NOTE.—The number of passengers carried is per mile of road.		
Passenger earnings per mile of road:		
1909, entire line	$2,649.53	$2,289.05
1909, State of Oklahoma	2,951.11	3,860.38
1907, entire line	2,408.30	2,254.01
Freight revenue per mile of road:		
1909, entire line	$5,485.95	$5,884.04
1909, State of Oklahoma	6,401.33	11,154.89
1907, entire line	5,990.50	6,606.59
Operating expenses per train-mile:		
1909, entire line	$1.41	$1.69
1909, State of Oklahoma	1.29	1.58
1907, entire line	1.31	1.68

The corporation commission issued an order, effective January 1, 1910, applying section 6, article 9, of the state constitution, which requires every railway or other public service corporation operating in Oklahoma to establish and maintain within the state a public office for the transaction of its business, where transfers of stock shall be made and where the books and records of the corporation shall be kept subject to inspection by the stockholders and the corporation commission. This action was taken by the commission because, as is charged, the railways denied access to books and papers which would show their actual earnings.

COURT NEWS.

The Louisville & Nashville has filed a petition in the United States circuit court for an injunction against the further enforcement of the Alabama 2½-cent passenger rate law. After six months' experience the road declares this rate unprofitable.

In the county court at Bastrop, Tex., November 16, suit was filed against F. T. Chase, master mechanic of the Missouri, Kansas & Texas, charging violation of the state law, passed this year, requiring the railway companies of Texas to do their repair work in that state.

Judge Smith McPherson, of the federal court, issued an injunction at Des Moines, Iowa, on November 29 temporarily restraining the Cedar Rapids & Iowa City Railway & Light Company from complying with the Iowa 2-cent fare law. Further hearing was set for December 15. The injunction was issued at the instance of Mrs. Elizabeth D. McClintock, of Haverford, Pa., one of the heaviest stockholders in the company, who contended that as applied to it the 2-cent fare is confiscatory.

Judge Cotteral, of the federal court, on November 29 at Guthrie, Okla., issued a temporary injunction restraining the state auditor of Oklahoma from collecting a tax of one-half of 1 per cent. of the gross earnings from the Atchison, Topeka & Santa Fe, the Gulf, Colorado & Santa Fe, the Chicago, Rock Island & Pacific and the Missouri, Kansas & Texas. The roads contend that the tax is virtually a franchise tax and that as their franchises were obtained from Congress before Oklahoma was admitted to statehood they are not subject to state taxation.

The justices of the supreme and circuit courts of South Carolina, sitting together, decided at Columbia, November 27, that the law of 1909, under which the Carolina, Clinchfield & Ohio seeks a charter in South Carolina, is unconstitutional. The law was made for the benefit of foreign corporations doing business in South Carolina, but the chartering of the Carolina, Clinchfield & Ohio was objected to by the attorney-general of the state on the ground that the road would always be able to carry all of its litigation to the federal courts. The opinion was by Judge E. B. Gary, and it is concurred in by nine other judges. A dissenting opinion by Chief Justice Jones is concurred in by four other judges.

In the United States circuit court for the Eastern district of Pennsylvania at Philadelphia, November 22, as mentioned in the *Railroad Age Gazette* last week, the demurrer filed by the Interstate Commerce Commission asking for the dismissal of the suit brought by the Baltimore & Ohio and other railways to enjoin the commission from enforcing its order of June 7, 1909, was sustained. The order established a rate on big vein coal carried from the George's Creek and Elk river regions in Maryland to Atlantic coast points in other states. The decision is also important to the shippers of coal in the Somerset region in Pennsylvania and the Austin-Newburg fields in West Virginia. These three fields are in sharp competition. The railways sought to have the commission enjoined from reducing the rate and the commission filed a demurrer asking for the dismissal of the suit, which the court sustained. The opinion was by Judge Buffington. The complainants in the action beside the Baltimore & Ohio were the Philadelphia & Reading, the Western Maryland, the Pennsylvania, the Cumberland Valley and the Lehigh & New England. The court unanimously held that the fixing of rates as an incident to the regulation of commerce is a non-judicial function, and that when the legislative branch has itself acted therein or by proper delegation of its powers has acted through

the Interstate Commerce Commission without violating a natural or constitutional right, the order of the commission cannot be suspended or vacated by a court. The court decided that when the question of suspending or setting aside such an act came before a court under such statute, the question is one of law, whether the commission transcended its power or exercised such power without due regard to law.

The supreme court of the United States on Monday last affirmed the decision of the circuit court for the district of Minnesota, restraining the enforcement of the order of the Interstate Commerce Commission reducing from $2 to $1 per car the charge to be exacted by the railways at Chicago for delivering cars of live stock to the stock yards. The decision was handed down by Justice Brewer. It turned upon the question as to whether the terminal charge in itself was reasonable. Deciding from the record that $2 was reasonable, the opinion held that if injustice was done to shippers by the through charge they should go to the original source of the unjust charge, and not to the terminal roads. Justice Brewer continued: If any shipper is wronged by the aggregate charge from the place of shipment to the Union Stock Yards, it would seem necessarily to follow that the wrong was done in the prior charges for transportation, and should be corrected by proper proceedings against the companies guilty of that wrong; otherwise injustice will be done. If this charge, reasonable in itself, be reduced, the Union Stock Yards Company will suffer loss, while the wrongdoers will escape. * * * While it might be more convenient for the commission to strike at the terminal charge, such a course would not serve the best purpose. "The convenience of commission or courts is not the measure of justice." The title of the case in which the decision was rendered was that of the Interstate Commerce Commission v. the receivers of the Chicago Great Western, and others. The commission's order reducing the terminal charge on cars of livestock was issued Dec. 10, 1907. On May 7 following the railways took the case into the federal circuit court, which court issued an injunction prohibiting the enforcement of the order. Justice Brewer's dicision now affirms that of the circuit court.

FOREIGN RAILWAY NOTES.

The report of the surveyors of the Trans-Australian Railway, from Port Augusta, in south Australia, to a connection with existing lines at Perth, in western Australia, is said to be favorable. The road will cost about $20,000,000.

The Prussian State Railways have discharged a number of men, chiefly laborers in Berlin freight-houses, for joining a social-democratic organization, which advocates striking to obtain concessions from the railway administration. It is expressly forbidden to join this organization, and this is one of the stipulations in the contract for employment.

Railway Projects in Turkey.

According to the American consul general at Beirut, Syria, representatives of large amounts of American capital are now on the lookout in Turkey for railway investments, and it is said that an American syndicate has received a grant, conditioned on no better terms being offered to the government within 16 months, for a railway from Sivas to Mosul and beyond, via Harput, Arghana, Diarbekir, Bitlis and Van. Such a road would be over 1,200 miles long, and it is expected that mines and oil fields along the line will help make it pay. The applicants ask for grants of rights in these mines and oil fields. A line over this route would help powerfully to develop Asia Minor. The public works minister of Turkey has under consideration schemes for 6,000 miles of new railways, of which five-sixths are in Asia and one-sixth in Europe. The consul general, in his report giving these facts, presents a list of 40 or more routes which make up this 6,000 miles. English capitalists are said to be asking concessions from the Turkish government, perhaps in rivalry for the line just mentioned. The Bagdad Railway, being built by Germans, is to be continued eastward across the Taurus mountains into Mesopotamia, traversing the vilayets of Broussa, Konieh, Adana, Aleppo, Mosul, Bagdad and Bosra.

Railroad Officers.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Thomas J. Walsh, secretary of the Cincinnati, Hamilton & Dayton, with office at Cincinnati, Ohio, has resigned.

Morrison L. Waite has been appointed general solicitor of the Cincinnati, Hamilton & Dayton, with office at Cincinnati, Ohio.

O. C. Van Zandt, auditor of the Gulf & Interstate at Galveston, Tex., has been appointed acting assistant secretary, with office at Galveston.

A. Patriarche, assistant to the president of the Pere Marquette at Detroit, Mich., has been elected vice-president in charge of traffic, with office at Detroit.

Frank E. Robson has been appointed general attorney of the Michigan Central, with office at Detroit, Mich., succeeding O. E. Butterfield, transferred to New York.

The title of L. A. Kerr, president and general manager of the Charlotte, Monroe & Columbia, has been changed to president and general superintendent, with office at Bee, S. C.

A. de Sola Mendes has been elected first vice-president of the Tampa & Jacksonville, with office at Gainesville, Fla. All heads of departments will report to the first vice-president.

E. B. Russell, chief clerk to the general superintendent of the Cincinnati, Hamilton & Dayton at Cincinnati, Ohio, has been appointed chief clerk to the president, with office at Cincinnati.

C. H. Jenkinson, local treasurer of the Oregon Short Line at Salt Lake City, Utah, has been appointed assistant treasurer, with office at Salt Lake City, and the title of local treasurer has been abolished. He will perform the duties heretofore assigned to him.

Robert R. Richards has been appointed assistant auditor of disbursements of the Michigan Central; Alfred S. Dutton, assistant auditor of freight accounts; George E. Smith, assistant auditor of passenger accounts, and Edward M. Cornell, assistant freight claim agent, all with offices at Detroit, Mich.

John C. Stuart, general manager of the Erie, whose election as vice-president of the Erie has been announced in these columns, has also been elected vice-president of the New York, Susquehanna & Western, in charge of the operating departments of both roads, with office at New York.

E. D. Sewall has been elected vice-president of the Tacoma Eastern, with office at Chicago. A. M. Ingersoll has been elected vice-president, with office at Tacoma, Wash.; E. W. Cook has been elected secretary, with office at Seattle, succeeding E. M. Hayden, resigned, and E. W. Adams, assistant secretary, with office at Milwaukee, Wis., succeeding Albert Cookingham, resigned.

Operating Officers.

Kepler Johnson has been appointed transportation inspector of the Atchison, Topeka & Santa Fe, eastern lines, Western district, with office at Newton, Kan.

A. L. Glass, general superintendent of the Tampa & Jacksonville, at Gainesville, Fla., has been appointed general manager, with office at Gainesville, and his former office of general superintendent has been abolished.

W. M. Weidenhamer, superintendent of the Sterling division of the Chicago, Burlington & Quincy at Sterling, Colo., has been appointed superintendent of the Alliance division, with office at Alliance, Neb., succeeding J. C. Birdsell, resigned. F. G. Robbins succeeds Mr. Weidenhamer.

J. W. Dean, superintendent of terminals of the Missouri Pacific-Iron Mountain system at St. Louis, Mo., has been appointed a general superintendent of the Denver & Rio Grande, with office at Denver, Colo. L. L. Kensinger has been appointed acting superintendent of terminals at St. Louis, succeeding Mr. Dean.

F. Bell, superintendent of the St. Cloud and Fergus Falls division of the Great Northern at Melrose, Minn., has been appointed assistant general superintendent of the Eastern district, with office at St. Paul, Minn. M. Nicholson, superintendent of the Butte division at Great Falls, Mont., succeeds Mr. Bell. C. O. Jenks succeeds Mr. Nicholson as superintendent of the Butte division.

T. S. Mahoney has been appointed assistant superintendent of the Gouldsboro district of the Texas & Pacific, with office at New Orleans, La., succeeding A. S. Wilson, resigned. W. M. Lynch, chief despatcher at Marshall, Tex., has been appointed assistant superintendent of the Avoyelles district, with office at Bunkie, La., succeeding W. G. Mason, resigned. W. T. Spencer succeeds Mr. Lynch.

H. C. Bixler, whose appointment as trainmaster of the Pennsylvania Tunnel & Terminal Co., which will operate trains into the new Pennsylvania terminal in the borough of Manhattan, New York, was recently announced in these columns, was born March 31, 1868, and began railway work with the Baltimore & Ohio as messenger in 1883, becoming telegraph operator in 1884. In 1887 he went to the Pennsylvania as a telegraph operator and was promoted to train despatcher in 1893. He was made chief train despatcher in 1903, and in 1906 was appointed assistant trainmaster in charge of the Pittsburgh terminal of the Pennsylvania, which position he held until his recent appointment.

C. H. Ketcham, formerly superintendent of the New York division of the Delaware, Lackawanna & Western, has been appointed superintendent of the Western division of the Western Pacific, with office at Sacramento, Cal.; R. H. Ogilvie, assistant division superintendent of the Chicago, Burlington & Quincy at Brookfield, Mo., has been appointed superintendent of the Eastern division, with office at Elko, Nev.; Mott Sawyer, construction trainmaster of the Chicago, Milwaukee & St. Paul, has been appointed trainmaster, with office at Sacramento; O. Meadows, superintendent of the Ocean Shore at San Francisco, Cal., has been appointed chief despatcher. E. L. Mason has been appointed superintendent of telegraph, with office at San Francisco.

F. W. Mahl, whose appointment as assistant to the director of maintenance and operation of the Harriman Lines, with office at Chicago, has been announced in these columns, was born on July 21, 1866, at Louisville, Ky. He graduated from Cornell University in 1889, having previously begun railway work in 1885 with the Chesapeake & Ohio as machinist apprentice. In July, 1889, he became a draftsman for the Schenectady Locomotive Works and two years later was made engineer of tests. He was appointed inspector of work in the motive power department of the Southern Pacific in August, 1894, and in the following year was made mechanical engineer. In November, 1906, he was appointed mechanical engineer and general purchasing agent of the Colorado & Southern lines, with office at Denver, Colo., which position he held until his recent appointment.

Page Harris, whose appointment as general superintendent of the Louisiana division of the Texas & Pacific, with office at New Orleans, La., has been announced in these columns, was born May 10, 1868, at Lawrence, Kan. He received his education at the University of Kansas, and began railway work as rodman on the Texas & Pacific in 1885. Later in that year he was appointed clerk in the office of the superintendent of transportation, where he handled general office work, personal injury and miscellaneous claims and spent part of the time on the road tracing cars. He held that position four years. He was then appointed general live stock agent and later general agent. In 1897 he was appointed chief clerk in the office of the vice-president and general manager, and in April, 1904, was appointed superintendent of the Eastern division, which position he held until his promotion to the present office in October of this year.

Traffic Officers.

E. L. Sheehan has been appointed a traveling passenger agent of the Canadian Pacific, with office at Chicago.

J. B. Lee has been appointed chief of the tariff bureau of the Chicago, Indianapolis & Louisville, with headquarters at Chicago.

C. H. Tate has been appointed assistant general freight and passenger agent of the La Crosse & Southeastern, with office at La Crosse, Wis.

H. E. Vernon has been appointed general agent of the Atchison, Topeka & Santa Fe, with office at Portland, Ore., in charge of the new agency at that place.

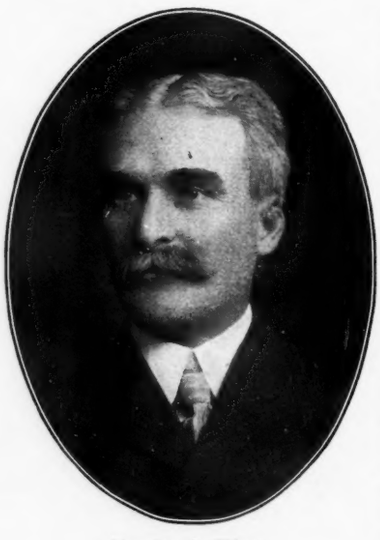
B. W. Schwartz has been appointed a traveling freight agent of the Piedmont Air Line, with office at Philadelphia, Pa., succeeding F. W. Hancock, assigned to other duties.

F. L. Matthews has been appointed district passenger agent of the Chicago Great Western, with office at Kansas City, Mo., succeeding George W. Lincoln, resigned to engage in other business.

T. F. Steele, general freight agent of the New Orleans & Northeastern, the Alabama & Vicksburg and the Vicksburg, Shreveport & Pacific at New Orleans, La., has been appointed freight traffic manager, with office at New Orleans. J. B. Bannon, assistant general freight agent at New Orleans, succeeds Mr. Steele, and his former office is abolished. Hereafter there will be but one assistant general freight agent of these lines.

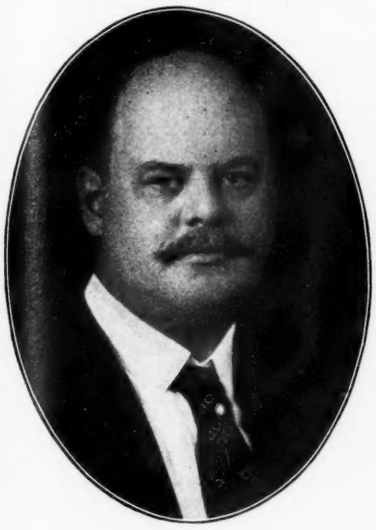
Charles A. King, general freight agent of the Toledo, St. Louis & Western and the Chicago & Alton at Chicago, has been appointed freight traffic manager of the Toledo, St. Louis & Western, the Chicago & Alton, the Minneapolis & St. Louis and the Iowa Central; George J. Charlton, general passenger agent of the Toledo, St. Louis & Western and the Chicago & Alton at Chicago, has been appointed passenger traffic manager of the four roads mentioned; Benjamin C. Stevenson, first assistant general freight agent of the Toledo, St. Louis & Western and the Chicago & Alton at Chicago, has been appointed assistant freight traffic manager of the four roads; S. G. Lutz, freight traffic manager of the Minneapolis & St. Louis and the Iowa Central at Minneapolis, Minn., has been appointed general freight agent of the four roads, and Robert J. McKay, first assistant general passenger agent of the Toledo, St. Louis & Western and the Chicago & Alton at Chicago, has been appointed general passenger agent of the four roads, all with offices at Chicago. A. B. Cutts, general passenger and ticket agent of the Minneapolis & St. Louis and the Iowa Central at Minneapolis, Minn., has been appointed assistant general passenger agent of the four roads, with office at Minneapolis.

Mr. King was born October 11, 1862, at Palmyra, Ill. He received a college education and began railway work in 1881 as check clerk in the local freight office of the Chicago & Alton at Kansas City, Mo. The following year he was made agent and telegraph operator, and later was consecutively secretary to the assistant superintendent and assistant despatcher at Slater, Mo.; agent at Odessa, Mo.; agent at Alton, Ill.; chief clerk in the general freight department at St. Louis, Mo.; traveling freight agent and division freight agent at Mexico Mo. In August, 1902, he was appointed assistant general freight agent and three years later was made general freight agent. He was appointed also general freight agent of the Toledo, St. Louis & Western on December 16, 1907.



Charles A. King.

Mr. Charlton was born September 9, 1860, at Hamilton, Ont. He was educated in the common and private schools and began railway work in 1875 as messenger boy in the general passenger department of the Chicago & Alton at Chicago. He was then successively junior clerk, conductor's clerk, ticket stock clerk, rate clerk and ticket accountant to March, 1885, when he became assistant general passenger agent, which position he held for five years. In January, 1900, he was made general passenger agent, and in December, 1907, was appointed also general passenger agent of the Toledo, St. Louis & Western.



G. J. Charlton.

Mr. Stevenson was born June 9, 1874, in Lewis county, Kentucky. He began railway work in 1890 as a yard clerk for the Chesapeake & Ohio at Maysville, Ky. He was later bill clerk and then cashier at Brighton Station, Cincinnati, Ohio, and subsequently became clerk in the local office of the Newport News & Mississippi Valley Company at Memphis, Tenn. He was made bill clerk in the local office of the Ohio & Mississippi at Cincinnati in September, 1892, and a year later was made clerk in the office of the commercial agent of the Baltimore & Ohio Southwestern at Cincinnati, and beginning in 1894 he was for five years rate clerk in the general freight office. He attended law school while holding the last-named position and was admitted to the bar at Columbus, Ohio, in June, 1899. He later practised law in Chicago and took a post-graduate course at the Northwestern University law school in that city. In August, 1900, he was appointed traveling freight agent of the Toledo, St. Louis & Western at Toledo, Ohio, and in October, 1903, was made commercial agent at Buffalo, N. Y. He was then transferred to Toledo and was appointed assistant general freight agent in March, 1905. In December, 1907, he was appointed first assistant general freight agent of the Toledo, St. Louis & Western and the Chicago & Alton.

B. C. Stevenson.

Mr. Lutz was born in Illinois in 1869. He began railway work with the Iowa Central in September, 1891, and filled various clerical positions to April, 1899, when he was appointed assistant general freight agent at Marshalltown, Iowa. In December, 1902, his headquarters were removed to Peoria, Ill., and two years later he was appointed also assistant general freight agent of the Minneapolis & St. Louis. In December, 1908, he was appointed freight traffic manager of both roads, with office at Minneapolis.

Charles Eikel, general agent of the Southern Pacific at Monterey, Mexico, and G. L. Moore, agent of the Missouri, Kansas & Texas at Wichita Falls, Tex., have been appointed traveling freight agents of the Southern Pacific Steamship Company.

Mr. McKay was born February 26, 1871, at Aurora, Ill. He received a common school education and began railway work in September, 1885, as messenger for the Chicago, Burlington & Quincy at Aurora. He was then consecutively clerk in the car accountant's office, clerk in the freight office, clerk in the road-master's office, assistant ticket agent and ticket agent at Aurora. In January, 1900, he was made city ticket agent at Chicago. He was appointed district passenger agent of the Toledo, St. Louis & Western at Chicago in September, 1904, and in January, 1906, was appointed assistant general passenger agent. He was later appointed also assistant general passenger agent of the Chicago & Alton, and in January, 1908, was appointed first assistant general passenger agent of both roads, which position he held at the time of his appointment as general passenger agent of the four Hawley roads mentioned above.

Robert J. McKay.

Mr. Cutts was born October 23, 1866, at Lillington, N. C. He received his education at Chatham Academy, Savannah, Ga., and at the Middle Georgia Military College, Milledgeville, Ga. He began railway work in 1884 as clerk in the ticket and auditing department of the Chicago & Alton, and from 1887 to 1890 was chief rate clerk in the office of the auditor of the Chicago, St. Paul, Minneapolis & Omaha. He was then made chief rate clerk in the general passenger department of the Great Northern, and two years later was made chief clerk in the general ticket and passenger department of the Minneapolis & St. Louis, which position he held to January, 1904. He was appointed general passenger and ticket agent of the Iowa Central in May, 1902, and in January, 1904, was appointed also to a like position on the Minneapolis & St. Louis.

Engineering and Rolling Stock Officers.

J. C. Pickering, chief engineer of the El Oro Mining & Railway Co., Ltd., at El Oro, Mexico, has resigned.

F. T. Fulkerson has been appointed assistant to the chief engineer of the Pan-American, with office at Gamboa, Oaxaca.

C. M. Stansbury, master mechanic of the Boca & Loyalton at Loyalton, Cal., has been appointed master mechanic of the Western Pacific, with office at Elko, Nev.

J. G. Bloom, district engineer of the Chicago, Rock Island & Pacific, at Topeka, Kan., has resigned, to become president and manager of the Southern Ballast Co., with office at Lester, Okla.

George S. McKee, superintendent of motive power and car equipment of the Mobile & Ohio, with office at Mobile, Ala., has resigned. He will continue with the company for some months in an advisory capacity.

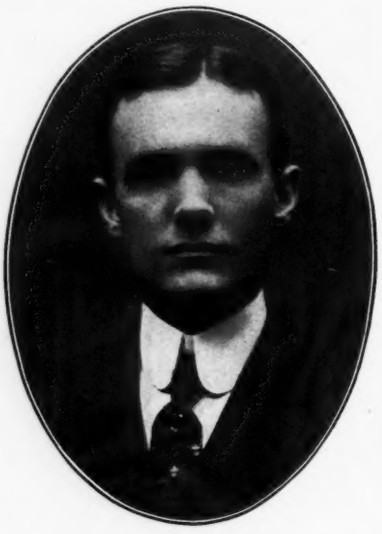
A. H. Barnes, acting supervisor of signals of the Northern Pacific, in charge of maintenance of signal apparatus, on lines west of Paradise, Mont., at Tacoma, Wash., has been appointed supervisor of signals, with office at Tacoma. E. A. Allen, acting supervisor of signals, in charge of maintenance of signal apparatus on lines east of Mandan, N. Dak., at Como shops, St. Paul, Minn., has been appointed supervisor of signals, with office at St. Paul.

W. F. Steffens, engineer of bridges and buildings on the Carolina, Clinchfield & Ohio at Johnson City, Tenn., has resigned, after four years' service, to go to the Boston & Albany as engineer of structures, with office at South station, Boston, Mass., effective December 10 or earlier. The duties of his

office will be taken over by M. J. Caples, second vice-president, general manager and chief engineer, with office at Johnson City.

R. A. Rutledge, division engineer of the Gulf, Colorado & Santa Fe at Temple, Tex., has been transferred to the Northern division, with office at Cleburne, Tex., succeeding Frank Merritt, promoted. K. B. Duncan, assistant engineer at Galveston, Tex., succeeds Mr. Rutledge. W. G. Massenburg, chief engineer of the Gulf & Interstate at Galveston, has been appointed a division engineer of the Gulf, Colorado & Santa Fe, with office at Beaumont, Tex.

Samuel Garver Thomson, whose appointment as assistant engineer of motive power of the Philadelphia & Reading and subsidiary companies, with office at Reading, Pa., has been announced in these columns, was born on November 19, 1875, at Cumberland, Md. He graduated from the Lawrenceville school in 1894 and from Princeton University in 1898. In October of the same year he began railway work with the Pennsylvania and later up to 1902 was a special apprentice at Altoona, Pa. He was then appointed motive power inspector at Altoona, Pa., since which time he has been consecutively general foreman at State Line, assistant master mechanic at Harrisburg, assistant engineer of motive power at Buffalo, N. Y., and later assistant engineer of motive power at Philadelphia, Pa., with the same company. He was appointed assistant engineer of motive power on the Philadelphia & Reading Nov. 15, 1909.



S. G. Thomson.

Purchasing Officers.

C. L. Buchanan has been appointed general storekeeper of the National Railways of Mexico, with office at San Luis Potosi, Mex., succeeding Charles O'Brien, resigned on account of ill health.

James W. Stuart, assistant general storekeeper of the Chicago, Burlington & Quincy, has been appointed temporary general storekeeper, with office at Chicago, succeeding Thomas A. Fay, deceased.

OBITUARY.

Edward C. Ensign, general baggage agent of the Erie at New York, died November 25, at the age of 54 years, at his home in Forest Hill, N. J. Mr. Ensign had been in the service of the Erie since 1887, and was appointed general baggage agent in 1893.

Major Henry Deming Bulkley, comptroller of the Baltimore & Ohio, died November 25 at Baltimore, Md., at the age of 80 years. Major Bulkley was born at Charleston, S. C., in 1831 and was educated in New York. He was made comptroller of the Baltimore & Ohio in 1889.

Peter H. Peck, for more than 20 years master mechanic of the Chicago & Western Indiana, was struck by a freight train at Seventy-ninth street, near Grand Crossing, Chicago, on November 28, and was so badly injured about the head that he did not regain consciousness and died that evening. A portrait of Mr. Peck and a sketch of his career were published in the *Railroad Age Gazette* November 5, 1909.

Railroad Construction.

New Incorporations, Surveys, Etc.

Atchison, Topeka & Santa Fe.—Work, it is said, has been started double-tracking this line between Ash Fork, Ariz., and Winslow, 115 miles.

See Gulf, Colorado & Santa Fe.

Atlanta, Birmingham & Atlantic.—An officer writes that contracts have been let to the Nicholas Contracting Co., of Atlanta, Ga., and Furtwaugler & Smith, of Birmingham, Ala., for work on 10 miles from Bessemer, Ala., northeast to Birmingham. (Nov. 12, p. 942.)

Atlantic, Quebec & Western.—A contract has been given to the New Canadian Co., Ltd., of Gaspe, Que., and work is now under way in Quebec on an extension from Grand river northeast to Douglastown, 46 miles. (March 19, p. 659.)

Au Sable & Northwestern.—An officer writes that a contract has been given to Eaton & Foote for building a three-quarter-mile line from Cooke, Mich., to Cooke dam.

Avoyelles, Palmetto & Gulf.—Incorporated in Louisiana, with $1,000,000 capital. The plans call for a line from Opelousas, La., northeast via Palmetto, Plaucheville and Moreauville to Natchez, Miss. E. A. Plauche, president; R. G. Hawkins, vice-president; J. H. Harmonson, secretary, and H. E. Estorge, treasurer. William A. Wall, of Meridian, Miss., is a director.

Bartlett & Florence.—An officer writes that work is now under way by the Bowers Construction Co., of Bartlett, Tex., on 11 miles, between Maxton and Florence. The company has projected an extension from Lampasas to Rockland, 94 miles. J. C. Collins, secretary, Bartlett. (Sept. 24, p. 562.)

Bee Tree.—This company, operating eight miles of line in Buncombe county, N. C., has surveys made for building an extension of about three-quarters of a mile. The work is to be started at once.

Birmingham-Canton & Vicksburg.—See Mississippi Roads.

Boston Elevated.—This company recently opened an extension from Dudley street, Boston, Mass., southwest to Forest Hills. A large passenger station was also opened at the southern terminus.

Blaney & Southern.—This company has projected an extension of five miles from Blaney, Mich., north towards Germfask.

Brooklyn Rapid Transit.—See mention of this company under General News.

Carolina, Clinchfield & Ohio.—An officer writes that work is under way by Rinehart & Dennis, Evans building, Washington, D. C., on a section of 10 miles from Keiser, Va., to Sandy Ridge. Surveys are under way from Sandy Ridge north to Elkhorn, Ky., 29 miles.

California Western Railway & Navigation Co.—According to press reports this company will build an extension to complete a line from Fort Bragg, Cal., on the Pacific coast, east to a connection with the Northwestern Pacific at Willets. The line is controlled by the Union Lumber Co. and is being operated from Fort Bragg east to the western foot of the divide, 28 miles. Rights-of-way have been secured to complete the line to Willets. The extension will cost about $1,000,000. It is expected that the work will be begun early next year.

Chicago & North Western.—According to press reports, surveys are being made for an extension from Peoria, Ill., south to Girard, about 80 miles. The work is to be started early next year.

Chicago, Burlington & Quincy.—According to press reports surveys have been made in northeastern Colorado and southeastern Wyoming on a total of about 300 miles for new extensions to be built as needed. This work, which has been provisionally arranged for, will ultimately cost about $10,000,000.

Contracts have not yet been let. The proposed extensions would be used in connection with the C., B. & Q. and the Colorado & Southern to secure new traffic from Colorado and Wyoming for shipments to the Gulf and to the East. Surveys are completed for an extension from the C., B. & Q. at Hudson, Colo., north to Greeley, 26 miles, which is to be further extended north to Grover, 48 miles, on the Cheyenne branch of the Burlington, and eventually will be extended into Wyoming, 130 miles. The line will have a grade of less than 1 per cent., and will provide a route for both these companies to the northwest. (Nov. 12, p. 942.)

CHICAGO GREAT WESTERN.—An officer is quoted as saying that plans are made for extensive improvements. This includes new equipment and laying new rails. Work is now under way putting in heavier rail and revising the grades. Plans are said to be under way to reduce the grade at the Chicago end of the Eastern division from 1 per cent. to one-half of 1 per cent.

CHICAGO, ROCK ISLAND & PACIFIC.—This company is building passing tracks, 3,000 ft. long, at Carnforth, Iowa, also a 3,000-ft. passing track between Earlham and De Sota, on the Iowa division.

CHICKASHA TERMINAL.—Incorporated in Oklahoma, with $10,000 capital and offices at Chickasha, Okla., and at Purcell. The company was organized to build a terminal system around Chickasha at a cost of $100,000. The incorporators include: D. Carter, C. E. Nelson, G. H. Parker, B. M. Haile, M. McMillin and W. H. Sparger, of Purcell, and J. M. Aydelotte, of Shawnee, Okla.

CLINTON, OKLAHOMA & WESTERN.—An officer writes that surveys are being made from Clinton, Okla., southeast to Lehigh, 188 miles. T. J. Nance, president, Clinton.

COLUMBUS & LAKE MICHIGAN.—An officer of the Columbus & Lake Michigan writes that the overhead construction is now being put in on that line preparatory to electric operations. This line is a part of the Ohio Electric Railways System.

COPPER RIVER.—According to press reports the Copper River & Northwestern will begin operating trains north from Cordova, Alaska, to the mouth of the Tiekel river, 102 miles, early in December. Work is under way on a large cantilever bridge at the Miles glaciers, to which point it is expected to have trains in operation by August, 1910. The line is expected to be finished to the Bonanza copper fields by December, 1910. (Nov. 5, p. 894.)

DULUTH & NORTHERN MINNESOTA.—An officer writes that work is under way by the company's men on about five miles of line in Minnesota, from mile post 60. Grading and bridge work are about two-thirds finished.

DULUTH, RAINY LAKE & PACIFIC.—An officer of the Duluth, Winnipeg & Pacific writes that contracts are about to be let for building from Virginia, Minn., south to Duluth, 74.4 miles. Address H. T. Hasen, room 619, Lyceum building, Duluth. (May 21, p. 1099.)

DULUTH, WINNIPEG & PACIFIC.—See Duluth, Rainy Lake & Pacific.

ERIE.—Work on the Pen Horn Creek, which was expected to be finished early next year, will have 4.74 miles of track laid by January, 1910. This is the four-track line being built through an open cut in Bergen hill, N. J., to connect the lines west of the present tunnel with the existing tracks east of the tunnel in Jersey City. (Nov. 19, p. 989.)

GAINESVILLE & SOUTHWESTERN.—See Mississippi Roads.

GARDEN CITY, GULF & NORTHERN.—An officer writes that surveys are being made from Scott City, Kan., to Oakley, 55 miles. The company recently finished 40 miles of line from Garden City to Scott City. The Kansas Construction & Irrigation Co. were the contractors. (Nov. 5, p. 894.)

GRAND TRUNK PACIFIC.—This company is said to have started operating through trains from Winnipeg, Man., west to Edmonton, Alb., 793.7 miles. (Nov. 19, p. 990.)

GULF & MAGNOLIA NORTHERN.—An officer writes that surveys are being made from Hope, Ark., southeast to Magnolia, 35 miles. S. Q. Sevier, president, Hope.

GULF & NORTHWESTERN.—An officer writes that surveys are being made from Sterling, Colo., southeast to Oklahoma City, Okla., 620 miles. E. F. Collins, chief engineer, Goodland, Kan. (June 18, p. 1329.)

GULF, COLORADO & SANTA FE.—According to press reports about $515,000 are to be spent improving the line from Berwyn, Okla., north to Purcell, and on the Atchison, Topeka & Santa Fe from Pauls Valley, Okla., northeast to Shawnee. These improvements are to be made to prevent the washing away of the roadbed during the rainy season.

GULF, TEXAS & WESTERN.—Work is now under way by D. J. Grisby, of Dallas, Tex., on an extension from Megargel, Tex., west to Seymour, 18½ miles. A further extension has been located from Seymour west to Benjamin, 32 miles.

HARRISVILLE & CORNWALLIS.—An officer writes that work is under way from Harrisville, W. Va., northwest to Cornwallis, 6.25 miles. The line is projected from Harrisville southeast to Burnsville, 45 miles additional. A. Wolverton, chief engineer, Philippi, W. Va. (Aug. 20, p. 339.)

HORNELL-BATH (ELECTRIC).—Application has been made to the New York Public Service Commission, Second district, for a certificate of convenience and necessity, to build an electric line from Hornell, N. Y., east to Bath, 23 miles. The company was organized last summer with $250,000 capital. The directors include: C. Adsit, C. H. Armsted and J. M. Finch, of Hornell, and J. F. Turk, of Hammondsport. (July 30, p. 215.)

INDIAN CREEK VALLEY.—Work is said to have started on an extension from Rodger Mills, Pa., to Jones Mills, 10 miles.

KENTUCKY HIGHLANDS.—Right-of-way is being secured from the present end of the line at Millville, Ky., to Versailles, about nine miles. The work is to be started early next spring. R. N. Huddon, Versailles, may be addressed.

KETTLE VALLEY LINES.—See Spokane & British Columbia.

KINSLEY, SCOTT CITY & DENVER AIR LINE.—An officer writes that surveys have been made to build from Anadale, Kan., to Olcott, in Pratt county, with a branch to the Missouri Pacific. The line is eventually to be extended northwest from Kinsley to Jetmore and to Scott City, thence to Denver, Colo. It has not been decided whether the tracks of the Missouri Pacific will be used from Wichita, Kan., to Anadale, or a new line built between these places. W. F. Brown, president, Noron, and R. E. Edwards, treasurer, Kinsley.

MEMPHIS UNION STATION CO.—This company, which was organized to build a union passenger station and terminals in Memphis, Tenn., for the Louisville & Nashville, the Nashville, Chattanooga & St. Louis, the Southern, the St. Louis, Iron Mountain & Southern and the St. Louis Southwestern, has been incorporated with $100,000 capital, and has given a mortgage for $3,000,000. It is possible that the Rock Island, the 'Frisco and the Illinois Central may be induced to join in the project. The estimated cost of the improvement will be $2,000,000. The incorporators include: M. H. Smith, of the Louisville & Nashville; J. W. Thomas, Jr., of the Nashville, Chattanooga & St. Louis, and F. Harrison, of the Southern. J. L. Lancaster, of Memphis, is president. C. W. Nelson, of the St. Louis Southwestern, is also interested. The former plan, which provided for carrying out the work on a larger scale, was dropped in July owing to the failure to apportion the expenses among the several roads interested.

MERIDIAN & PASCAGOULA RAILROAD & STEAMSHIP CO.—See Mississippi Roads.

METROPOLITAN STEAM & ELECTRIC.—Incorporated in Delaware, with $100,000 capital, to build a system of electric lines to connect San Antonio, Tex., with New Braunfels, Austin, Seguin, Lockhart and Gonzales, and eventually to build from San Antonio to Houston and to Galveston. Some surveys have been made and grading is expected to be started this year. John G. Marmion, of San Antonio; E. L. Squire, of Wilmington, Del., and M. Kauffman, of Yorktown, are interested.

MEXICAN ROADS.—The Cananea Consolidated Copper Co., it is said, will again call for bids for building from Del Rio, Sonora, east to Agua Prieta, thence to the Mexican Central. L. O.

Ricketts is general manager of the copper company. (July 2, p. 35.)

An English syndicate, represented by Harris Walthal, has been granted a concession by the state of Durango to build from Durango northwest to San Dimas, in the Sierra Madres, about 125 miles.

The Mexican Pacific Development Co., of Seattle, Wash., is said to have started work on a narrow-gage line in the state of Guerrero, Mex., northwest along the Pacific coast, connecting the ports of Acapulco and Zihuatanejo, about 100 miles. Some of the material has already been bought from the Mitchell Mining Co., which projected a line from Acapulco to the La Dicha copper mines, and this project has since been abandoned. Moritz Thompson and J. D. Trenholme, both of Seattle, are said to be interested.

The federal government is said to be building a line through the Quintana Roo Yucatan section of Mexico, and the work has already reached the center of the Maya Indian territory.

Mineral Wells & Northwestern (Electric).—According to press reports from Mineral Wells, Tex., a contract has been entered into between this company and residents of Mineral Wells and Fort Worth to build a line to connect both those places. Judge J. A. Watkins and P. Hurley, Fort Worth, are interested.

Minneapolis & Rainy River.—An extension is projected from Deer River, Minn., south to Remer, 18 miles.

Mississippi Roads.—Under the names of the Gainesville & Southwestern, the Meridian & Pascagoula Railroad & Steamship Co., and the Birmingham-Canton & Vicksburg, three new lines of railway are to be built in Mississippi. The promoters include: W. A. Hall, of Meridian; William Cornell, of Lake, Miss.; W. J. Francis, of Birmingham, Ala., and C. M. Whitworth, of Mendenhall, Miss.

Missouri Pacific.—See item regarding this road under General News.

Muskogee, Hartshorne & Southern.—Incorporated in Oklahoma, with $100,000, capital, with office at Oklahoma City, Okla. The plans call for a line from Muskogee, south through Haskell, Latiber, Pittsburgh, Pushmataha and Chotaw counties, thence to Paris, Tex., about 180 miles. The estimated cost of the line is $6,500,000. The incorporators include: H. R. Blauvelt, J. E. Armstrong and R. F. Goff, of Oklahoma City; A. D. Dailey and C. R. Day, of Edmond, Okla.

National Railways of Mexico.—See item regarding this road under General News.

Nevada-California-Oregon.—An officer writes that work is now under way on an extension from Alturas, Cal., north to Lakeview, Ore., 60 miles. (Sept. 17, p. 521.)

Northern Electric.—During 1909 this company built 5.7 miles from Sacramento, Cal., to the Sacramento water front. Surveys now under way for an extension from Yuba City, Cal., east to Colusa, 24 miles.

Northwestern Pacific.—The new extension of the Broad Gage division from Duncans Mills, Cal., to Monte Rio, has been put in operation. The company has constructed a steel bridge over the Russian river, near Camp Vacation, and finished the work on 1.61 miles of new line connecting the Gurneyville Valley branch at Camp Vacation with the line at Monte Rio. (July 9, p. 79.)

Ocean Shore.—Work is now under way between Tunitas Glen, Cal., and Scott creek, on 26½ miles. The Ransome-Crummey Co., of Oakland, Cal., and Lilly & Heinz, of Santa Cruz, Cal., are the contractors.

Oklahoma & North Texas.—A projector writes that this company is to be incorporated this month to build from Durant, Okla., southeast to Paris, Tex., 65 miles. The line will at a later time be electrified. Bonuses and land grants, valued at $70,000, have been promised. Samuel Graham & Co., of Montreal, Canada, are to be the fiscal agents. D. A. & L. S. Powers, associated with bankers of Durant, are back of the project.

Oklahoma Central.—This company has started condemnation proceedings to secure right-of-way for a line and terminal facilities into Chickasha, Okla.

Pacific & Idaho Northern.—Surveys are being made for an extension from Evergreen, Idaho, northeast to Meadows, 17 miles.

Pacific Railway & Navigation Co.—This company, which was organized to build 91 miles of line from Hillsboro, Ore., west to Tillamook, has track laid on 40 miles. Work is now under way by the J. W. Sweeney Construction Co. and Robert Wakefield, both of Portland, on a section of 41 miles between Timber and Garibaldi. George L. Davis, chief engineer, 507 Wells-Fargo building, Portland. (Sept. 17, p. 521.)

Pen Horn Creek.—See Erie.

Pennsylvania Railroad.—With the completion on November 23 of the third tunnel of the Pennsylvania under the East river to Sunnyside yard, Long Island City, the construction of the company's tunnel lines from Bergen hill, N. J., to Sunnyside yard has been accomplished, with the exception of 150 ft. in the approach of tunnel "D" to Sunnyside yard and some work at the Long Island shafts. All of this work will be completed before the end of 1909. (Oct. 1, p. 614.)

Philadelphia & Reading.—Contracts, it is said, are about to be let for grading and construction for four tracks between Perkiomen, Pa., and Norristown junction. This work will complete the four-track system from Phoenixville to Valley Forge. (Oct. 29, p. 828.)

Philadelphia & Suburban (Electric).—This company has withdrawn its application for a charter to build an elevated line on Twelfth and Thirteenth streets, Philadelphia, from the northern to the southern end of the city. Application has been made to build a subway under Broad street to Cumberland street and from that place to operate an elevated line to Frankford, Wayne Junction and Strawberry Mansion. The plans call for a main line running through a subway from Broad and Filbert streets to Broad and Cumberland streets, thence over an elevated structure to Lehigh avenue, along Lehigh avenue to Thirty-third street to Ridge avenue and York street, with a loop terminal opposite Strawberry Mansion. The line to Frankford will also be through the subway from City Hall to Cumberland street, on Broad street, thence over an elevated structure to Lehigh avenue, and east along Lehigh avenue to Kensington avenue, and along Kensington avenue to Frankford avenue. Plans are also made to build a double-track elevated line from the intersection of Park avenue and Lehigh avenue, north on Park avenue to Glenwood avenue, thence northeast on Glenwood avenue to Twelfth street, then north along Twelfth street to Clearfield street. This line is to have a physical connection with the Pennsylvania Railroad near North Philadelphia station. The Wayne junction line is to begin at the termination of the subway, thence over the North Philadelphia elevated to Twelfth and Clearfield streets, and east on Clearfield street to Germantown avenue, and north along that avenue to Wingohocking street, then west over private right-of-way to Wayne avenue, south along Wayne avenue to Roberts avenue, thence east on Roberts avenue to Germantown avenue, then returning to the place of beginning. S. S. Neff, president, 416 Franklin Bank building, and Edwin O. Lewis, counsel, Philadelphia. (Sept. 10, p. 479.)

Phoenixville, Valley Forge, Stratford & Philadelphia (Electric).—This company proposes to build an electric line from Phoenixville, Pa., southeast to Philadelphia. A. W. Klay, president, and L. E. Miller, both of Phoenixville.

Prescott, Reader & Fordyce.—An officer writes that this company is operating a six-mile line from Reader, Ark., west to Lydia, and has projected an extension from Lydia west to Prescott, 18 miles. Plans are being made to build a further extension from Prescott to Fordyce, 75 miles.

Rochester, Syracuse & Eastern.—See Syracuse, Lake Shore & Northern.

St. Louis & Houston Mineral Belt.—An officer writes that surveys are being made from Houston, Mo., south to Sargent, 23 miles. E. K. Lyles, secretary, Houston. (July 30, p. 215.)

Salem, Falls City & Western.—An officer writes that surveys have been made for an extension from Blackrock, Ore., to Siletz Basin, seven miles. (Nov. 12, p. 944.)

Salisaw, McAlester & Southern.—An officer writes that

surveys are being made from Salisaw, Okla., southwest for about 200 miles, to Lawton. Work is now under way by the J. C. Wilkinson Co., of McAlester, on a 10-mile section from Savannah north to McAlester. (Oct. 15, p. 727.)

SOUTHERN.—According to press reports contracts have been given recently for laying double-track on several 10-mile sections at various places in Georgia and work is now under way. Similar work is also being completed in Virginia and North Carolina. It is the intention of the company to double-track the entire line between Atlanta, Ga., and Washington, D. C. Work will be under way soon between Charlotte, N. C., and Atlanta. (Oct. 22, p. 778.)

SOUTHERN PACIFIC.—The report of this company for the year ended June 30, 1909, shows that during the year the following lines were opened for operation: California & Northeastern, Dorris, Cal., north to Klamath Falls, Ore., 22.52 miles; Central California, Niles, Cal., to Newark, 5.15 miles; Nevada & California, Mojave, Cal., south to Mabel, 91.40 miles; Sacramento Southern, Sacramento, Cal., south via Del Rio to Freeport, 8.11 miles; Southern Pacific, Peart, Cal., to Howard, 1.89 miles; San Ramon, Cal., to Radum, 9.58 miles; Famosa Junction, Cal., to Famosa, 1.04 miles; Texas & New Orleans, Gallatin, Tex., south to Rusk, 7.79 miles. During the year the work which has been under way for several years changing the gage on the South Pacific Coast railway from 3 ft. to standard on the main line of 105.18 miles, and 46.05 miles of sidings was finished. To provide for the increasing traffic to and from San Francisco, Cal., the steam lines are being double-tracked and electrified from Alameda Mole to Melrose, 8.42 miles, and to High street, Alameda, 6.91 miles; also from Oakland junction to Twentieth street and San Pablo avenue, Oakland, 1.84 miles, a total of 17.17 miles. The changes in line, completed, or in course of construction, were as follows: Lines east of El Paso, Tex.—Alleytown to Colorado river, 3.17 miles; between Glidden and mile post No. 7 on La Grange branch, 3.62 miles. Lines west of El Paso.—Deeth, Nev., to Wells, 16.31 miles; Piute to Argenta, 16.01 miles; Rocklin, Cal., westbound to Colfax, 8.81 miles, and Oswego, Ore., to Cook, 5.28 miles. The concessions granted for the construction of lines in the republic of Mexico were transferred to the Southern Pacific Railroad Co. of Mexico, which was incorporated in the state of New Jersey on June 24, 1909. The new company acquired all the rights, property and franchises of the Cananea, Yaqui River & Pacific and the several concessions granted to that company and to the Southern Pacific Co. Under these concessions there was completed during the year 251.74 miles of line, a total of 783.85 miles, completed to June 30, out of 1,502.71 miles, projected. The mileage projected under these concessions is shown below:

			Remaining to be built—	
	Projected.	Constructed to June 30, 1909.	Under construction.	To be built.
Main line—				
Empalme to Guadalajara.	852.69	594.43	86.02	172.24
Branch lines	650.02	189.42	96.62	363.98
Total	1,502.71	783.85	182.64	536.22

Under the concessions to the Southern Pacific Company, 272.24 miles remain to be completed by November, 1912, and, under the concession to the Cananea, Yaqui River & Pacific Railroad Company, 446.62 miles to be completed by May, 1914. See the report elsewhere in this issue.

According to press reports, double-tracking work has been authorized from Tracy, Cal., north to Stockton, 20 miles. The cost of the improvements will be about $500,000. It is expected that similar work will shortly be authorized from Stockton north to Brighton, 45 miles, on which the work will cost about $1,000,000. The double-tracking from Brighton to Sacramento has recently been finished. A second track has been laid from Brighton to Elvas, from which point three tracks have been laid into Sacramento. (Nov. 12, p. 944.)

SPOKANE & BRITISH COLUMBIA.—An officer writes that surveys are being made for an extension from Republic, Wash., southeast to Spokane, 120 miles.

An officer of the Kettle Valley lines writes that an extension is projected from Midway, B. C., northwest to Nicola, 230 miles. (Nov. 19, p. 991.)

SYRACUSE, LAKE SHORE & NORTHERN (ELECTRIC).—An officer of the Rochester, Syracuse & Eastern writes that the double-track line from Port Byron, N. Y., east to Syracuse, has been finished on 22 miles and will be put in operation this year. (Feb. 19, p. 381.)

TEXAS ROADS.—According to reports from Lufkin, Tex., surveys are being made from the present end of the line of the Angelina County Lumber Co. to Chireno. Plans, it is said, are under consideration to build an extension from Chireno east to San Augustine.

Residents of Waco, Tex., are interested in a project to build a line from Waco southwest to Georgetown, about 80 miles. George W. Taylor, of Waco, may be addressed.

THAYER JUNCTION.—Incorporated in Illinois, with $65,000 capital, and office at Chicago. The plans call for a line from Thayer, in Sangamon county, Ill., southwesterly to a point on the Chicago, Burlington & Quincy, at Thayer junction, in Macoupin county. The incorporators include: A. L. Sweet, T. A. Lemon, W. Farmer, E. H. Jones and G. C. Maston, all of Chicago.

TRINITY VALLEY & NORTHERN.—An officer writes that contracts have been let to S. L. Powell and P. Razor, both of Dayton, Tex., for building a three-mile extension from a point three miles north of Fouts. The line is to be further extended 11 miles to Rayburn.

VERA CRUZ & ISTHMUS.—Contracts are said to have been let by this company for grading a branch from Rives, Vera Cruz, north to San Andres, Tuxtla, about 50 miles, to McGavock & Borrowe, of the City of Mexico, who also have a sub-contract for work on the Southern Pacific of Mexico. (Nov. 19, p. 992.)

VIRGINIA WESTERN.—Incorporated in Virginia, with $200,000 capital, to build from a point in Highland county, Va., at the West Virginia state line, south to Clifton Forge, about 80 miles. Bids are to be asked for at once and the work is expected to be finished within two years. J. J. Stoutenburgh, president; A. V. Huyler, vice-president; B. N. Bovie, secretary, and J. G. Ropes, treasurer, all of New York.

WEST VIRGINIA NORTHERN.—An officer writes that this company, which is now in operation for 11 miles in Preston county, W. Va., will build an extension from Kingwood station to the town of Kingwood, about three-quarters of a mile.

WISCONSIN & NORTHERN.—A contract has been given to the McDonell-O'Connor Co., of Shawano, Wis., for an extension from Van Ostrand, Wis., east to Wolf river, 5.25 miles. (July 16, p. 126.)

FOREIGN RAILWAY NOTES.

The authorization for the electrification of suburban lines of the Central of Brazil has been approved.

An advance in the freights of the Austrian State Railways is to begin Jan. 1 next; but it will be much less for exports than for other freight.

Plans are being considered for a bridge over the Ganges at Sara, India, for the Eastern Bengal Railway. The bridge will be over a mile long and will cost about $6,500,000.

On the 15th of October last three of the most important Austrian railways, having together about 1,900 miles of road, came under the management of the state.

Permission has been given to the Compania General de Ferrocariles en la Provincia de Buenos Ayres to build meter-gage lines within the zone of the Puerto de la Plata.

The street railways in Elberfeld, not earning their charges, raised the fare from 10 to 15 pfennige (2.4 to 3.6 cents). The result for the first two months was disappointing. The travel fell off so much that there was but an insignificant increase in earnings. In September, for instance, had there been no decrease in travel the earnings would have been 10,200 marks larger, while the actual increase was but 477 marks.

Railroad Financial News.

CAROLINA, CLINCHFIELD & OHIO.—See an item in regard to this company in Court News.

CHICAGO, BURLINGTON & QUINCY.—See an item in regard to this company in General News.

CHICAGO, LAKE SHORE & EASTERN.—On June 1, 1909, all the property of the Chicago, Lake Shore & Eastern was leased for 60 years to the Elgin, Joliet & Eastern. Under the terms of the lease the E. J & E. agreed to pay the Chicago, Lake Shore & Eastern $4,000,000 cash, and the recent increase in the outstanding capital stock of the E. J. & E. from $6,000,000 to $10,000,000 was presumably in connection with this payment. Both companies are controlled by the United States Steel Corporation, and the entire $9,000,000 stock of the C., L. S. & E. was issued at par for cash and is owned by the Illinois Steel Co.

Wm. A. Read & Co., New York, are offering the unsold portion of $9,000,000 first mortgage 4½ per cent. bonds of the Chicago, Lake Shore & Eastern at 106½, yielding about 4.20 per cent. Principal and interest on these bonds are guaranteed by the Elgin, Joliet & Eastern and by the U. S. Steel Corporation.

DETROIT, TOLEDO & IRONTON.—The *Commercial and Financial Chronicle* says: "We learn that the last coupon paid on the 4½ per cent. equipment trust notes dated June 1, 1905, of which $1,656,000 remains unpaid, was that of December 1, 1907. On account of the default, the equipment for which the notes were issued was by order of court surrendered to the American Car & Foundry Co., but as no adjustment had been made of the original obligation, the latter was included in the balance sheet of June 30 last."

ELGIN, JOLIET & EASTERN.—See Chicago, Lake Shore & Eastern.

GRAND TRUNK.—See Pontiac, Oxford & Northern.

LOS ANGELES PACIFIC CO.—Stockholders are to vote January 6 on the question of issuing $20,000,000 forty-year 4 per cent. bonds to provide for improvements and additions and to retire existing bonds to the amount, it is said, of $10,656,000. Of the $20,000,000 stock $10,000,000 is owned by the Southern Pacific. The company operates 570 miles of track.

MEMPHIS UNION STATION CO.—See this company under Railroad Construction.

NEW YORK CENTRAL & HUDSON RIVER.—The New York Public Service Commission, Second district, having approved the issue of $44,658,000 new stock, the company is offering to stockholders of record December 10 the right to subscribe at par to new stock to the extent of 25 per cent. of their present stock holdings. The Public Service Commission made the following restrictions on the new issue of stock:

Of the proceeds of the sale, $21,966,615 is to be used toward the payment of $25,000,000 three-year 5 per cent. notes maturing February 10, 1910. No part, however, of the sum received from the sale of new stock is to be used in retiring the remaining $3,033,385, because the commission holds that this amount is not properly chargeable to capital account. The remaining $22,691,385 to be received from the sale of the stock may be used to pay for extensions and improvements, but not more than $9,000,000 of it is to be used for the payment of new equipment and rolling stock.

The New York Central has been given permission by the New York Public Service Commission, Second district, to subscribe to $420,800 additional stock of the New York, New Haven & Hartford. The petition says that the Central owns $1,124,800 stock of the New Haven company, and $206,300 3½ per cent. convertible debentures and $421,000 6 per cent. convertible debentures, which gives it the right to subscribe for 4,208 shares of new stock at 125.

PONTIAC, OXFORD & NORTHERN.—The property of this company, which has been in the hands of a receiver for about two years, has been bought by the Grand Trunk.

SOUTHERN PACIFIC.—It is understood that this company has bought two lines from the El Paso & Southwestern running between Courtland and the Nacozari line and between Douglas and the Nacozari line.

Late News.

The items in this column were received after the classified departments were closed.

The Detroit, Toledo & Ironton, which is in the hands of a receiver, defaulted on the interest due December 1 on its general lien and divisional first mortgage 4 per cent. bonds, and a protective committee has been formed, of which Otto T. Bannard is chairman.

The stockholders of the Chicago & North Western are offered by the company an amount of new common stock equal to 25 per cent. of their holdings on January 10. At present there is $99,618,839 common stock outstanding, so that the new stock issue will amount to $24,904,710.

The Buffalo, Rochester & Pittsburgh has placed a contract with the Allis-Chalmers Co., Milwaukee, Wis., for a timber preserving plant, to be erected at Bradford, Pa. It is intended to creosote, using the full-cell process, all cross ties, switch ties, bridge timber, etc. The plant will have a capacity for treating 250,000 ties a year.

The Portland, Lake View & Eastern has been incorporated in Arizona, with headquarters at Phoenix, Ariz., and an office at Portland, Ore. The plans call for a line from Portland southerly and easterly to Lake View in Lake county, or to a point on Goose lake in the same county, with a branch from the main line near Lower Bridge on the Des Chutes river in Crook county easterly to a point near Canyon City; also another branch from Prineville southerly and easterly to Harney lake. About 500 miles of line is to be built in Oregon. The incorporators include W. S. Dexter, C. S. Elgutter, E. S. Robinson, J. Burns and S. R. Rheinstrom, all of Omaha, Neb.

The strike of switchmen in the northwest, reported in another column, appears to have tied up freight traffic almost completely from St. Paul to the Pacific coast, but the press reports are fragmentary and incomplete and at some places the switchmen did not desert their jobs. At this writing (Thursday) no great delays to passenger traffic are reported. Flour mills at Minneapolis and smelters at Great Valley, Mont., are reported shut down, because of inability to run except as products can be constantly shipped out; but it is impossible to say how extensively this condition prevails. Messrs. Knapp and Neill have returned from St. Paul to Washington, their services as mediators not being accepted.

The Pennsylvania has made plans for improvements, to include a new branch to be built from Park place, Newark, N. J., to Harrison. The tracks from Harrison to Jersey City will also be electrified and direct connection made with the Hudson & Manhattan east of Marion station, Jersey City. This will provide a new electric train service from Newark into Jersey City and a direct route into the Church and Cortlandt streets terminals of the Hudson & Manhattan. Passengers may also transfer at the new station in Harrison and go direct to the Pennsylvania station at Seventh avenue and Thirty-third street, New York, as well as to points on Long Island. The new station in Newark will occupy a central location fronting on Park place and adjoining Saybrook place. The final plans for the station have not yet been made.

The Chicago, Rock Island & Pacific has sold to B. F. Yoakum, Edwin Hawley and associates the $28,634,900 common stock of the St. Louis & San Francisco pledged as security for 5 per cent. collateral trust bonds of the Chicago, Rock Island & Pacific. R. G. Reid, W. H. Moore, U. H. Moore, F. L. Hine, R. A. Jackson, H. U. Mudge and E. S. Moore were elected as an executive committee of the C., R. I. & P. D. G. Reid was elected chairman of the executive committee and R. A. Jackson, vice-chairman. B. L. Winchell, president of the C., R. I. & P., was elected president of the St. Louis & San Francisco, succeeding A. J. Davidson, recently resigned, and H. U. Mudge was elected president of the C., R. I. & P., succeeding Mr. Winchell. B. F. Yoakum was elected chairman of the executive committee of the Frisco. The other members of the executive committee elected were Edwin Hawley, B. L. Winchell, James Campbell, Frank Trumbull, E. V. R. Thayer and Thomas H. West.

Supply Trade Section.

The Bucyrus Co., South Milwaukee, Wis., recently sold four 95-ton shovels to the Northern Pacific.

H. C. Sharpe, formerly with Jos. T. Ryerson & Son, Chicago, is now connected with the Lackawanna Bridge Co., Buffalo, N. Y.

The C. H. Besley Tool Co., Chicago, has let the contract for a third floor addition to its plant, which will give 9,000 sq. ft. additional floor space.

The Buda Foundry & Manufacturing Co., Chicago, announces that hereafter it will be known as the Buda Company. There is no change in the organization.

P. G. Jenks, formerly general manager of the Western Steel Car & Foundry Co., at Chicago, is now with Banning, Cooper & Co., Ltd., Pittsburgh, Pa. He took up his new work on November 19.

Percival Roberts, of Philadelphia, Pa., and Samuel Mather, of Cleveland, Ohio, have been elected directors of the United States Steel Corporation, succeeding Marvin Hughitt and William Edenborn.

A Buffalo paper recently published a story in which bearing metal made by the Dodge Manufacturing Co., Mishawaka, Ind., was taken for silver by counterfeiters, police and reporters. Counterfeit money and dies were found, together with a bar of bearing metal.

Charles C. Wright has secured an interest in the Cleveland Tool & Supply Co., Cleveland, Ohio, and after December 1 will be connected with that firm. For several years Mr. Wright has been a salesman in the Cleveland office of the Carnegie Steel Co., Pittsburgh, Pa.

The American Specialty Co., Chicago, has been appointed sole export agent for the line of portable electric drilling machines made by the Van Dorn Electric & Manufacturing Co., Cleveland, Ohio. The American Specialty Co. also has the agency for these tools in the Chicago and central western districts.

Welling G. Sickel, having disposed of his interest in the United and the Globe Rubber Manufacturing Companies, has become associated with C. M. Hewitt and H. H. Hewitt, New York. He will hereafter represent the Hewitt Rubber Co., the Magnus Metal Co., the Hewitt Supply Co. and the National Brake Shoe Co.

The Electric Storage Battery Co., Philadelphia, Pa., has made a change in management of its southern sales office. H. H. Seaman, the former manager, having resigned, A. N. Bentley has been appointed to take charge of this office. Mr. Bentley has had a comprehensive storage battery experience as the engineer of the Cleveland office of the company.

The Winters-Coleman Scale Co., Springfield, Ohio, has secured control of the Osgood automatic scale. All prices or quotations made by or on behalf of the Osgood Scale Co. on automatic scales will be withdrawn without further notice on December 31. The Winters-Coleman company makes a specialty of automatic scales. It has branches in Chicago, New York and New Orleans, and agents at all other grain centers. It makes the Sonander automatic hopper scale for weighing grain, mill products, etc.

The Pennsylvania Inspection Bureau, Harrisburg, Pa., has been organized with a capital of $5,000. The incorporators and officers are: J. C. Wickersham and S. Arch Replogle, both of Johnstown, Pa., and James Plummer, of Pittsburgh, Pa. Mr. Wickersham has been a chief inspector for the United States government for the last eight years. The offices will be in the Johnson Trust building in Johnstown, Pa. The company is equipped to handle all chemical and physical testing, and to inspect rails, locomotives, cars, structural steel, car wheels, axles and building materials.

The Imperial Supreme Court at Leipsic, Germany, has decided in favor of an American company a case appealed from the decision of the patent office. The latter had rescinded the patent rights of the American company on the ground that it had not put the invention on the market within three years of the time the German patent was secured. The Supreme Court decision holds that the German-American patent agreement, effective August 1, applies in this case. The agreement provides that American manufacturers do not have to manufacture their products in Germany in order to sell them there, and that they are also relieved of the three-year restriction mentioned above, patents being protected in both countries if manufacture is carried on in either.

Robert A. Paterson, manager of the railway department at New York of Fairbanks, Morse & Co., Chicago, will leave that firm on January 1 to become vice-president of the Watson Insulated Wire Co., Chicago, with office in the Railway Exchange building. The Watson company is the western agent of the Kerite Insulated Wire & Cable Co., New York. Mr. Paterson was born in 1867 at Newburyport, Mass. He received a public school education, graduating from the high school at Binghamton, N. Y. He afterwards entered the Peekskill Military Academy and prepared for West Point. He did not go there, however, preferring a commercial career. He went into the selling business when he was 17 years old, and for a number of years handled various specialties, organized sales forces and developed new methods. For the last 10 years he has been with Fairbanks, Morse & Co. in charge of the railway department in various territories. He has been active during the last four years as an executive member of the Signal Appliance Association, and was chairman of that organization during the year ending October 13, 1909.

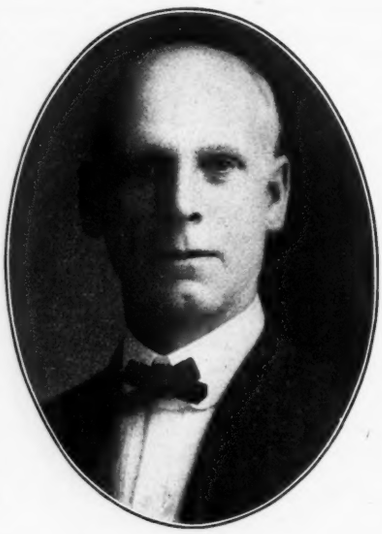
R. A. Paterson.

The H. K. Porter Co., Pittsburgh, Pa., is running full with full force at full time. Some of the recent orders booked include two 15 x 20, 30-in. gage steel works locomotives for the Carnegie Steel Co.; one 16 x 20, 36-in. gage, and two 8 x 14, 56½-in. gage locomotives for the Tennessee Coal, Iron & Railroad Co.; four 20 x 26, 56½-in. gage locomotives for the Monongahela Connecting Railroad; six 17 x 20, 56½-in. gage shifting locomotives for the Indiana Steel Co.; one 14 x 20, and two 18 x 24, 56½-in. gage steel works locomotives for the Jones & Laughlin Steel Co.; four 12 x 16, 56½-in. gage steel works locomotives for the Dominion Iron & Steel Co.; one 15 x 20 and one 16 x 20, 36-in. gage steel works locomotives for the Bethlehem Steel Co.; one 13 x 18, 56½-in. gage locomotive for the Thompson Brothers Lumber Co., of Texas.; also quite a number of 9 x 14 and 10 x 16 contractors' locomotives for various concerns, several compound air locomotives for coal mines, and several locomotives for Japan and other foreign countries.

John Caldwell, treasurer of the Westinghouse Air Brake Co., Pittsburgh, Pa., died of heart disease in his office on November 23. Mr. Caldwell had been associated with George Westinghouse since the inception of the Westinghouse Air Brake Co. He was born in Ireland about 70 years ago, and came to Pittsburgh as a lad of 12, where he worked in a grocery store. On the organization of the air brake com-

pany in 1869 he became its bookkeeper, a position he retained for 10 years. He was then elected treasurer. When the Westinghouse Electric & Manufacturing Co. was organized, Mr. Caldwell was made treasurer of that. He retained the position until the organization was put on a smooth running basis, when he resigned in 1892 to give his entire time to the air brake company. This was also true of the Philadelphia company, to which he was also elected treasurer when this company was organized, resigning in 1899. At the outbreak of the Civil War he was enlisted as a private in the Company E, Sixty-first Pennsylvania Volunteers, and was mustered out as a second lieutenant at the close of the war. He was wounded at the battle of Spottsylvania. Mr. Caldwell had a wide reputation as an art connoisseur and collector of rare books.

William J. Robertson, eastern representative of the W. H. Miner Co., Chicago, and formerly master car builder of the Central Vermont, died in New York on November 19 after a few days' illness. The funeral services were at St. Albans on November 21. Mr. Robertson was born in London, England, in 1851. He came to the United States and began railway service in 1869 as assistant master mechanic on the Portland & Kennebec at Augusta, Me. Two years later he went to the Central Vermont and served until 1885 as mechanical engineer and chief draftsman in locomotive and car shops at St. Albans, Vt. He was then made superintendent of motive power of that road, and in 1892 was made master car builder. In 1900 he went to the Ely mines at Copperfield, Vt., as master mechanic, and in 1901 went to the W. H. Miner Co. to take the position which he held up to the time of his death. Mr. Robertson was just and fair in all his dealings. He held the friends he made during both his railway work and the later years of his life by his straightforward methods of business, his loyalty and his personal attractiveness. He was not a bore. This was not due so much to watchfulness of his hearer's attitude, but rather to his knowledge of his subject and his understanding of human nature, so that he knew intuitively how to make his case clear and then stop.



W. J. Robertson.

S. L. Nicholson has been appointed general sales manager of the Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa., and has direct charge over the sales policies of the entire company. Mr. Nicholson has been with the company for 11 years in many different capacities, as salesman, as district department manager, and as industrial and power sales manager for the past five years, from which last position he resigned to take the present post. Before coming to the Westinghouse company he was with the C. & C. Electric Co. He is perhaps best known to motor manufacturers as the organizer and president of the American Association of Motor Manufacturers, an organization which has done much in the two short years of its life to improve the art of manufacturing motors. Charles Robbins, who has for many years been connected with the Westinghouse Electric & Manufacturing Co. in the industrial and power sales department, in connection with the sale of industrial motors, has been appointed manager of this department. Mr. Robbins has been with the company since 1899, in which time he has been in the manufacturing department, the New York district office sales department, and for the past three years in the industrial and power sales department at East Pittsburgh. His headquarters will continue to be at East Pittsburgh. G. Brewer Griffin has been appointed manager of the detail and supply sales department of the Westinghouse Electric & Manufacturing Co., in which department transformers, meters, fans, heating appliances, switches, switchboards, railway line material, etc., are sold. Mr. Griffin has been assistant manager of this sales department for six years past, having previously been connected with the sale of detail apparatus in the Boston office, altogether having been employed some seven years with this company. Previous to his connection with the Westinghouse company, Mr. Griffin was with the Manhattan General Construction Co., New York, as a special representative, finally opening an office for that company in Boston. Samuel A. Chase, who for the past few years has been with the Westinghouse Electric & Manufacturing Co. in its New York sales office as a special detail and supply salesman, has resigned to accept a position with the White Investing Co., New York, a financial investment company handling stock of many different organizations. Previous to Mr. Chase's employment with the Westinghouse Electric & Manufacturing Co. he was a salesman for the Western Electric Co., Chicago. Mr. Chase will, after January 1, be in charge of the Chicago office of the White Investing Co., having exclusive territorial rights in North and South Dakota, Minneapolis, Iowa, Illinois and northern Indiana.

TRADE PUBLICATIONS.

Taps and Dies.—A folder issued by the Wells Brothers Co., Greenfield, Mass., lists, with sizes and prices, the company's line of Little Giant screw taps and dies, with stocks.

Coal Cutters.—Bulletin No. 18 of the Jeffrey Manufacturing Co., Columbus, Ohio, illustrates and describes electric and air power coal cutters. Photographs show several types of machines at work in coal mines. Trucks, electric mine locomotives and electric drills are also shown.

Union Pacific.—The passenger department of the Union Pacific has issued a folder about the National Corn Exposition to be held at Omaha, Neb., December 6-18, 1909. Views of the city and of last year's exposition are used to illustrate detailed information about the nature and objects of the big exposition.

Motors and Generators.—Bulletin No. 116 of the Crocker-Wheeler Co., Ampere, N. J., describes motor generator sets for all purposes. Each of these sets consists of a d.c. or a.c. motor driving one or more d.c. or a.c. generators. A number of sizes and types are illustrated and described. Bulletin No. 118, superseding bulletin No. 98, takes up form L direct-current motors in sizes from $^1/_{20}$ to 7½ h.p. Illustrations of a number of installations of these machines are given.

Tubes.—Catalogue H of the National Tube Co., Pittsburgh, Pa., covers the products made at the Kewanee works, including wrought pipe for steam, gas, water and air, cast malleable iron and brass fittings, brass and iron body valves and cocks, etc. The catalogue is a fully indexed volume of 470 pages and is bound in leather. The presswork is particularly excellent. A feature which adds much to its appearance and clearness is the printing of the text and illustrations in different colors. Part of the text is black, but the majority is a soft, very dark, shade of green, which, while as clear as black, is a pleasant change and makes the work distinctive. The cuts of the Kewanee union are printed in black and brass color, which is a happy way of showing this union of iron to brass.

RAILROAD STRUCTURES.

Abilene, Tex.—The Texas Railroad Commission will hold a public hearing on December 14 to consider the question of the railways building a union station at Abilene. The new structure would be for the use of the Texas & Pacific, the Wichita Valley and the Abilene & Southern.

Camp Vacation, Cal.—See Northwestern Pacific under Railroad Construction.

Columbia, S. C.—The Seaboard Air Line, it is said, will

soon start work on a steel trestle to replace the present wooden structure at Columbia.

HAZEN, NEV.—The annual report of the Southern Pacific for the year ended June 30, 1909, shows that a six-stall brick and concrete engine house and a steel deck turntable was put in at a cost of $45,323. Work is now under way on the construction of additional yard tracks and rearrangement of the yard. The estimated cost of this improvement is $70,000.

KANSAS CITY, MO.—The board of directors of the Kansas City Terminal Railway Company has approved the plans prepared by Jarvis Hunt, of Chicago, for the new union passenger station. The action of the directors must yet be ratified by the stockholders of the several railways. The ordinance requires the construction of a station to cost $2,800,000, but it is stated that it has been decided to build a station to cost $5,750,000. It will be located near the corner of Main and Twenty-third streets. The frontage will be 512 ft. and the train sheds 1,400 ft. long. The exterior will be of stone, concrete and steel. The general lobby will be 350 ft. long and 160 ft. wide, and the ceiling will be 115 ft. high. There will be three levels, the level of the station proper; the train service level, which will be reached by elevators, and below this still the baggage, express and postal rooms.

MEMPHIS, TENN.—See Memphis Union Station Co. under Railroad Construction.

MONTREAL, QUE.—Plans, it is said, are being made by the Montreal Street Railway for putting up the following shop buildings: Car building, machine, electrical and winding, blacksmith and paint shops; also a large building in which to store material and supplies.

NEWARK, N. J.—The Pennsylvania Railroad has made a proposition to the city officials of Newark, N. J., to reconstruct the Center street bridge over the Passaic river. In connection with this work, the city may build a viaduct across Front street, to connect with the bridge.

OLA, ARK.—The Chicago, Rock Island & Pacific has let the contract to the Otto Gas Engine Co., Chicago, for the coal chute mentioned last week. It is to be of 150 tons capacity, 28 ft. x 24 ft., 66 ft. high, and will cost approximately $6,000. The hoisting machinery will be driven by gasolene power.

OMAHA, NEB.—The Omaha & Council Bluffs Street Railway Co. advises that Lichter & Jens, St. Louis, Mo., are preparing plans for a power plant which it is planned to erect within the next two years.

PORTLAND, ORE.—The Portland Railway, Light & Power Co. is to build a car barn at East Twenty-eighth and Ankeny streets. The construction is to be fireproof and the plans include offices and club rooms for the men. Contracts have been let to W. F. Barstow & Co., a local contracting firm.

PUEBLO, COLO.—According to press reports revised plans for the Rio Grande and Missouri Pacific joint shops have been made. The cost of the improvement is to be $750,000.

SAN ANTONIO, TEX.—The report of the Southern Pacific for the year ended June 30, 1909, shows that work is under way on a steel viaduct, a concrete subway and a brick and concrete freight house for the Galveston, Harrisburg & San Antonio at San Antonio. The estimated cost of these improvements is $263,200.

TULSA, OKLA.—The Atchison, Topeka & Santa Fe and the Midland Valley are planning to build jointly a passenger station in Tulsa.

WATERLOO, IOWA.—The Waterloo, Cedar Falls & Northern is to build a steam power plant. Turbo-generator sets aggregating 4,000 to 5,000 h.p. are to be installed.

The Argentine Minister of Public Works has made a contract with the Buenos Ayres Great Northern, according to which the railway will extend the Juancho line from a point near Laguna, Gongora, to a connection with the line from Maipu to Mar del Plata.

Equipment and Supplies.

LOCOMOTIVE BUILDING.

The Chicago & Western Indiana is in the market for 10 switch locomotives.

The Illinois Traction System is in the market for six 50-ton electric locomotives.

The St. Louis Southwestern has ordered 16 locomotives from the Baldwin Locomotive Works.

The Hocking Valley, as mentioned in the *Railroad Age Gazette* of November 19, is figuring on 13 locomotives.

The Pere Marquette, as mentioned in the *Railroad Age Gazette* of November 26, is figuring on 22 locomotives.

The Atlanta, Birmingham & Atlantic has ordered two mikado locomotives from the Baldwin Locomotive Works.

The Erie is said to have ordered 10 switching locomotives, five of them being from the company's shops. This is not yet confirmed.

The Chicago & Alton has ordered from the American Locomotive Co. the 10 mikado locomotives mentioned in the *Railroad Age Gazette* of November 26. The engines will have cylinders 24 in. x 30 in., and will weigh 271,000 lbs.

The Carolina, Clinchfield & Ohio, as mentioned in the *Railroad Age Gazette* of November 19, has ordered from the Baldwin Locomotive Works three Pacific locomotives and four Mallets (2-6-6-2), with the privilege of increasing its order for the latter type to 10 engines.

General Dimensions.

Type of locomotive	Mallet.	Pacific.
Weight on drivers	360,000 lbs.	160,000 lbs.
Total weight	400,000 "	260,000 "
Diameter of cylinders	25 & 39x32 in.	23 in. x 30 in.
Diameter of drivers	57 in.	69 in.
Type of boiler	Straight top, radial stay.	Ext. wagn top.
Working steam pressure	200 lbs.	190 lbs.
Heating surface, tubes	5,804 sq. ft.	3,917 sq. ft.
" " firebox.	210 "	203 "
" " total	6,014 "	4,120 "
Tubes, number	471	318
" outside diameter	2¼ in.	2¼ in.
" length	21 ft	21 ft.
Firebox, length	117 in.	108⅛ in.
" width	96 "	72¼ "
Grate area	78 sq. ft.	55 sq. ft.
Tank capacity, water	10,000 gals.	8,000 gals.
Coal capacity	15 tons.	14 tons.

Special Equipment.

Axles	Hammered steel (Mallet)
Bell ringer	Gollmar
Boiler lagging	85% magnesia
Brakes	Westinghouse
Brake-beams	Buffalo
Brake-shoes	Perfecto
Couplers	Major
Driving boxes	Cast steel (Mallet)
Headlight	Pyle electric
Injector	Nathan Monitor
Piston and valve rod packings	Trojan metallic
Safety valve	Consolidated
Sanding devices	Leach
Sight-feed lubricators	Nathan Bull's-eye
Steam gages	Ashcroft
Steam heat equipment	Gold (Pacific)
Tires	Open-hearth or crucible steel
Tubes	Seamless cold-drawn steel
Valve gear	Walschaerts

The Intercolonial Railway has ordered 10 consolidation locomotives from the Canadian Locomotive Co. and one Pacific passenger locomotive from the Montreal Locomotive Works.

General Dimensions.

Type of locomotive	Consolidation.	Pacific.
Weight on drivers	148,300 lbs.	126,000 lbs.
Total weight	164,850 lbs.	187,000 lbs.
Cylinders	21 in. x 28 in.	21 in. x 28 in.
Diameter of drivers	56 in.	72 in. outside.
Type of boiler	Straight top.	.....
Working steam pressure	200 lbs.	200 lbs.
Heating surface, tubes	1,934.6 sq. ft.	2,584 sq. ft.
" " firebox	161.1 "	162 "
" " total	2,095.7 "	2,746 "
Tubes, number	236 or more.	232
" outside diameter	2¼ in.	2¼ in.
" length	14 ft.	19 ft.
Firebox, length	114 in.	96 in.
" width	41 "	70 "
" material	Homogen. stl.	Homogen. st'l.
Grate area	32½ sq. ft.	.....
Tank capacity	5,000 I. gals.	5,000 I. gals.
Coal capacity	10 tons.	10 tons.

Special Equipment.

Axles	Open-hearth steel.
Bell ringer	Automatic
Boiler lagging	Asbestos sectional (Pacific)
Brakes	Westinghouse
Brake-beams	Simplex (Pacific)
Brake-shoes	Am. Brake-Shoe & Fdry. Co. (Pacific)
Brick arch	3 x 12 in. bricks (Consolidation)
Couplers	Janney (Consolidation M. C. B. Washburn or other approved type (Pacific)
Driving boxes	Cast steel, Ajax bearings (Consolidation)
Headlight	Pyle National electric
Journal bearings	McCord 5½ in. x 10 in. (Pacific)
Piston and valve rod packings	U. S. Metallic
Sanding devices	Wilson
Springs	Peach & Tozer (Consolidation)
Steam heat equipment	Safety Car Htg. & Ltg. Co. (Consolidation); Safety Car Htg. & Lag. Co., in conjunction with Economy car heating system (Pacific).
Valve gear	Shifting link
Wheel centers	Solid disc centers (Consolidation) Cast steel (Pacific)

The Public Belt Railroad, New Orleans, La., advises that it is contemplating ordering new locomotives, but no specifications have as yet been prepared.

CAR BUILDING.

The Illinois Traction System is in the market for 30 express trail cars.

The Third Avenue Railroad, New York, has ordered 100 cars from the J. G. Brill Co.

The St. Louis Southwestern has recently completed 12 coaches in its Tyler, Tex., shops.

The Ft. Worth & Denver City has built four box cars at the Childress, Tex., shops, and will build 18 more.

The Colorado & Wyoming has ordered 50 thirty-ton rebuilt side-dump cars from the Hicks Locomotive & Car Works.

The Twin City Rapid Transit Co., Minneapolis, Minn., is building 100 cars for its lines and 11 for the Duluth City Ry.

The Toledo & Ohio Central is said to have ordered 1,000 cars from the Ralston Steel Car Company. This is not yet confirmed.

The Southern Railway has ordered from the Lenoir Car Company the 1,000 box cars mentioned in the *Railroad Age Gazette* of Oct. 22.

The Interborough Rapid Transit Co. has ordered 20 flat cars from the Ralston Steel Car Co. and is figuring on 200 or 300 passenger cars.

The Comox & Campbell Tramway is negotiating with the American Car & Foundry Co. for 100 flat cars. The company is owned by the Frazer Lumber Co.

The Provident & Gulf Coast advises that it has not yet been decided what type of locomotives and cars it will buy, but, at present, prices on motor cars are desired.

The Procter & Gamble Company is in the market, through its office at Port Ivory, Staten Island, N. Y., for second-hand flat cars, low side gondolas and box cars 36 ft. to 42 ft. long.

The Northern Pacific advises that the order for the Lidgerwood cars mentioned November 19 has not yet been placed. The matter is still under consideration and probably will be settled soon.

The Lake Superior & Ishpeming has ordered 100 ore cars. The order was placed with the Clark Car Co., which owns patents on the Clark ore car. The Ralston Steel Car Co. will build the cars.

The Central of New Jersey has ordered one vestibule combination car and four vestibule coaches, and is figuring on 10 open platform coaches. The vestibule cars will have steel underframes and the specialties will be similar to those of the open platform cars mentioned in the *Railroad Age Gazette* of April 16.

The Carolina, Clinchfield & Ohio is asking prices on 12 first-class coaches, as mentioned in the *Railroad Age Gazette* of November 12. These cars will measure 59 ft. 3 in. long and 8 ft. 10 in. wide, inside, and 60 ft. long and 9 ft. 8 in. wide, over all. Underframes will be of steel. The special equipment includes:

Axles	Open-hearth steel
Brakes	Westinghouse
Brake-shoes	Diamond S.
Couplers	Major
Draft gear	Miner
Heating system	Gold
Journal boxes	McCord
Lighting system	Pintsch single mantle, or incandescent single mantle system
Platforms	Steel
Seats	Heywood Bros. & Wakefield
Side bearings	Perry roller
Vestibules	Pullman standard width
Vestibule trap doors	Edwards
Wheels	Steel
Window fixtures	National Lock Washer Co.

The Intercolonial Railway has ordered 30 steel coal cars from the Dominion Car & Foundry Co. These cars will measure 36 ft. 9½ in. long and 9 ft. 7 in. wide, inside, and 38 ft. 10 in. long and 10 ft. ¼ in. wide, over all. The special equipment includes:

Axles	Steel
Bolsters, body	Hart-Otis
Brakes	Westinghouse
Brake-beams	Simplex
Couplers	Janney
Draft gear	Miner tandem
Dust guards	Bass wood
Journal boxes	M. C. B., 5½ in. x 10 in.
Springs	M. C. B., Class D
Trucks	Hart-Otis
Wheels	Cast iron, 33-in.

MACHINERY AND TOOLS.

The Waterloo, Cedar Falls & Northern is to build a power plant at Waterloo, Iowa, as mentioned under Railroad Structures.

The Bethlehem Steel Co., South Bethlehem, Pa., is in the market for a list of tools to be installed in the addition to the South Bethlehem plant.

The Omaha & Council Bluffs Street Railway is preparing plans for a power plant to be built at Omaha, Neb., as mentioned under Railroad Structures.

The Laramie, Hahns Peak & Pacific has ordered from the American Locomotive Co. one rotary snow plow with a 6,500-gallon tender. The plow is to make a 10-ft. 7-in. cut.

The Isthmian Canal Commission, Washington, D. C., asks bids up to December 3 on one 10-yard dipper dredge (Circular No. 543). Bids are asked up to December 14 on 181,000 lbs. of carbon tool steel (Circular No. 544). Bids are asked up to December 20 on steam castings for steam shovel repair parts, steel rope, chain, pipe cutters, carpenters' tools, etc. (Circular No. 545).

IRON AND STEEL.

The Erie has ordered 20,000 kegs of spikes.

The Havana Central is in the market for 1,200 tons of rails.

The Toledo & Ohio Central has ordered from the Carnegie Steel Co. 3,000 tons of rails for 1910 delivery.

The Chicago, Indiana & Southern has ordered from the Illinois Steel Company 1,300 to 1,500 kegs of spikes and an equal number of kegs of bolts.

The Lake Shore & Michigan Southern has ordered 11,000 to 13,000 kegs of spikes, and 3,000 to 4,000 kegs of bolts, from the Illinois Steel Company.

The Lake Erie & Western has ordered from the Illinois Steel Company 2,300 to 2,500 kegs of spikes, 700 to 800 kegs of bolts and 18,000 to 20,000 pairs of angle bars.

The Lehigh Valley has ordered 7,500 tons of rails from the Bethlehem Steel Co., 4,000 tons from the Lackawanna Steel Co. and 2,500 tons from the Carnegie Steel Co.

The Isthmian Canal Commission, Washington, D. C., asked bids up to November 29 on frogs, 150,000 tie plates, 20,000

angle bars, 113,000 lbs. of track bolts and 300,000 lbs. of track spikes.

The Tampa & Jacksonville is in the market for 10 miles of 60-lb. rail with 12 to 15 frogs and switches, to take the place of lighter rails now in track. Relaying rails, with angle bars attached, are preferred. Address A. de Sola Mendes, vice-president, Gainesville, Fla.

General Conditions in Steel.—Many steel mills are refusing to accept orders for delivery in the first quarter of next year. The earliest delivery promised on a recent order for 10,000 tons of steel bars was June. Contracts for delivery in the first six months of 1910 are being taken at advances of from $1 to $3 a ton. Structural steel orders for the current month will amount to about 100,000 tons, and there is a large volume of work pending. The market for rails is quieter, but structural material continues strong.

SIGNALING.

The Atchison, Topeka & Santa Fe is rebuilding the electric interlocking plant at Independence, Kan., recently destroyed by fire.

The Burlington is planning to rebuild the mechanical interlocking plant at the Rock Island crossing at Peru, Ill. The tower will be of brick.

The Rock Island is rearranging the mechanical interlocking plant at Carnforth, Iowa, at the crossing of the Chicago & North Western on account of building a new passing track at that point.

The Western Pacific will install a 40-lever electric interlocking machine at its western terminus. There will be 33 working levers. The railway has bought the material from the General Railway Signal Company and will build the plant with its own forces.

The Chicago & North Western has under construction a 40-lever electric interlocking plant at Main street, Evanston, Ill. There will be 29 working levers. Electric locking will be provided in addition to detector bars. The General Railway Signal Company is doing the work.

The Chicago, Milwaukee & St. Paul is building a 32-lever mechanical interlocking plant at the crossing of the Chicago & North Western at Groton, S. Dak. There will be 23 working levers. Time locks will be provided for through routes. Distant signals on the St. Paul will be power operated.

A 12 working lever mechanical interlocking plant is being installed at the crossing of the Gulf, Colorado & Santa Fe with the Galveston, Harrisburg & San Antonio at Stella, near Harrisburg, Tex. This plant will be equipped with track circuit electric locking, annunciators and power-operated distant signals.

The Chicago & North Western expects to complete the changes in automatic block signals between Chicago and Evanston (Davis street) in the near future. These changes were made necessary by the construction of a third main track and the elevation of all tracks through the terminal district. The signals consist of home and distant Hall disks.

The Baltimore & Ohio is to erect automatic block signals between Washington Junction, Md., and Brunswick, Md., seven miles; and also is to install a large interlocking plant at the east end of Brunswick yard. The Baltimore & Ohio Southwestern is to erect automatic block signals on its main line, double track, between Cincinnati and Loveland, Ohio. All of the signals will be three-position, upper-quadrant, and the lamps will be electrically lighted.

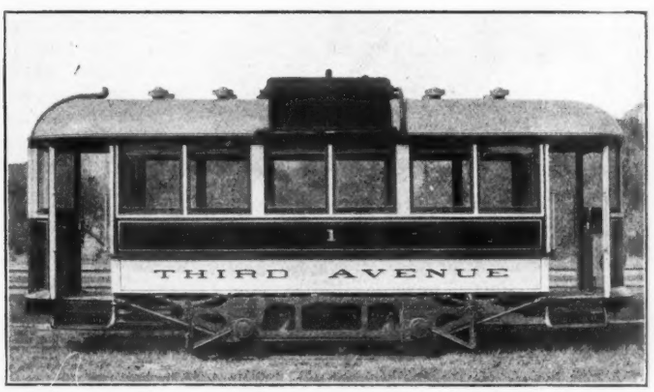
A 23 working lever mechanical interlocking plant is being installed at the crossing of the Opelousas, Gulf & Northeastern with the Louisiana Western at Rayne, La. This plant also will be equipped with track circuit electric locking, annunciators and power-operated distant signals. The installation of the Stella plant is under the direction of the signal department of the G., H. & S. A., while that in Louisiana is being installed under the direction of the O., G. & N. E.

The Rock Island has just put in service three-position, upper-quadrant, normal-clear, automatic block signals between Iowa City, Iowa, and Valley Junction, Iowa, 12.9 miles of double track and 109.5 miles single track. The double track is between Altoona and Valley Junction. There are 129 single-arm and two double-arm automatic block signals, 13 single-arm and one double-arm semi-automatic signals and five crossing bells. There are 56 switches protected by switch indicators, uusally two to each switch, one to indicate the approach of eastward and the other of westward trains. The signals are style "S" and the relays 9C, furnished by the Union Switch & Signal Company. The same company furnished the switch indicators, relay boxes and cable posts. The operating battery for each signal consists of 16 cells, potash, housed in Massey concrete wells. The line batteries consist of six cells, gravity, each. Polarized line circuits are used throughout on the single track. Line relays are of 50 ohms resistance. All signal control circuits are taken through a circuit controller on each facing point in the block. The work was all done by the Rock Island signal department forces.

Gasolene-Electric Street Car.

Conditions of street car service where an overhead trolley is not permitted, and the cost of a conduit system is prohibitive, have resulted in the design of a self-propelled gasolene-electric motor car for this use. One of these cars was recently placed in operation on the 125th street line of the Third Avenue Railroad, New York.

The generating unit of this car consists of a four-cylinder, four-cycle gasolene engine, direct connected to an electric generator and an exciter. The unit is completely enclosed, though readily accessible for inspection or repairs. It is



Gasolene-Electric Street Car.

mounted between the axles of the truck and below the car floor, so that the interior of the car is unobstructed. A 22-h.p. standard railway motor is mounted on each axle.

A Bosch low-tension magneto supplies the ignition, which is of the make-and-break magnet plug type. The engine is started by a crank direct from the magneto, and, being provided with an automatic centrifugal throttle governor, runs at constant speed, regardless of the speed of the car.

The car is operated from either end by electric controllers similar to those of an ordinary trolley car. The motors may be connected progressively in series and parallel, and further speed regulation is obtained by steps of resistance in the generator field circuit. The operator has no auxiliary levers for controlling the gas engine or the car.

The exciter supplies power for the main generator field and for lighting the car. The car has no monitor, its roof being dome-shaped, with suction ventilators. Water cooling radiators are placed on the roof over the center of the car and are connected to the water jackets of the cylinders by pipes enclosed within the center posts of the car. The circulation is semi-siphon. In cold weather the car is heated by hot water pipes

under the seats, through which the engine circulating water is passed.

The truck is of special light construction of riveted plate frame, equipped with ball-bearing journal boxes. The truck frame is supported on coil springs and is steadied by half-elliptic springs at the end of the truck frame.

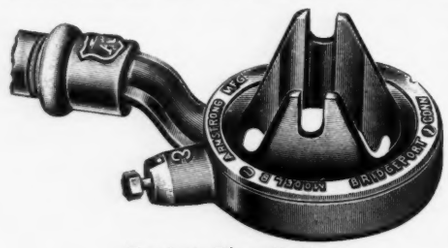
Following are some of the dimensions and weights: Length over all, 28 ft.; length of body over end frames, 19 ft.; wheel base, 7 ft. 6 in.; height from rail to top of roof, 12 ft.; width overall, 8 ft.; seating capacity, 26; weight completely equipped, 12 tons.

The equipment was made by the General Electric Company, Schenectady, N. Y., the car body being built by the Wason Manufacturing Company, Springfield, Mass., and the truck by the American Locomotive Company, New York.

It seems quite possible that this type of car may find general acceptance among street railway men for owl service, as self-contained cars will save the expense of operating the main power house between midnight and the early morning hours. On steam railway lines the car should prove useful for branch service where the runs are long and the traffic light, on which a steam locomotive and one or two cars must now be maintained at a comparatively high operating expense. For such service, the gas-electric motor car can be geared for a speed of 25 to 30 miles an hour, and will answer every requirement at a total operating expense of 14 to 16 cents per car mile. For construction work on steam and electric lines the truck can be equipped as a flat car with a plain canopy roof and open sides and ends.

Ratchet Pipe Cutter.

The accompanying cut illustrates the new model B ratchet attachment recently put on the market by the Armstrong Manufacturing Co., Bridgeport, Conn. With this ratchet attachment applied to an Armstrong stock an apprentice can cut pipe with ease.



Rachet Pipe Cutter.

It is not necessary to buy an extra stock, as this attachment can be applied to stocks already in use. It is now made to fit the following Armstrong stocks: Nos. 2, 2½ and 3. The Nos. 1, 6 and 7 will be ready for the market soon.

Robert M. Van Arsdale.

Robert M. Van Arsdale died at his home in New York, on November 23, in his 61st year.

Van Arsdale's success was due to his enormous acquaintance and the esteem of those acquaintances. It was a valuable acquaintance because it was special, being among the railway mechanical officers and the manufacturers for that railway department, and including nearly all of them. It has been commonly said that Van Arsdale had no enemies, and it must have been quite nearly true. He was equable, contented and always serene. He had the attributes of a Christian Scientist long before the name was known to him, and he embraced that religion about as soon as he heard of it.

He has been a successful publisher, making the *American Engineer* a power in its own field of railway working. His first successful work was on the staff of the *Railroad Gazette*, from 1875 to the end of 1881, and his use of the first large sum of money, got by frugality and hard work, was characteristic. He used it all in buying a city house for his mother. She had always wanted a city house. Then he saved for himself and bought the publication with which his name has since been associated.

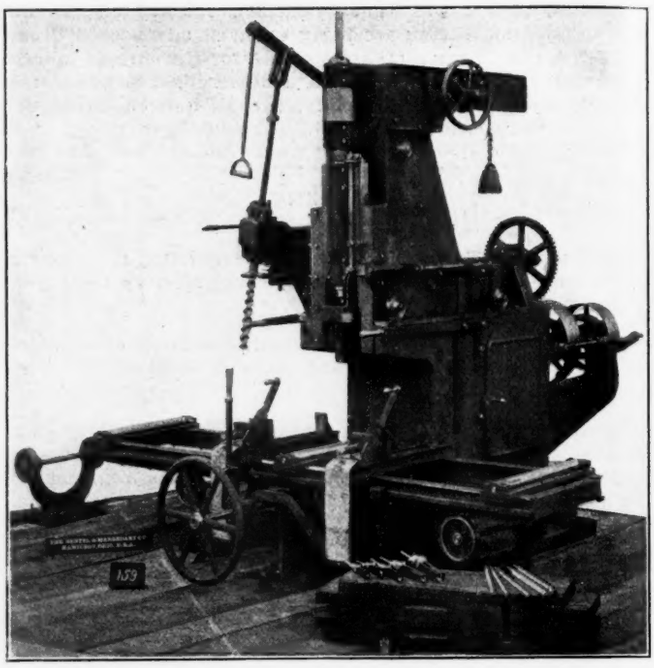
Van Arsdale was a fine type of the valuable citizen who quietly does his work, with few public appearances, and, nevertheless, leaves a name kindly remembered by a great many people.

Recent Machine Tools.

Wood-Working Tools.

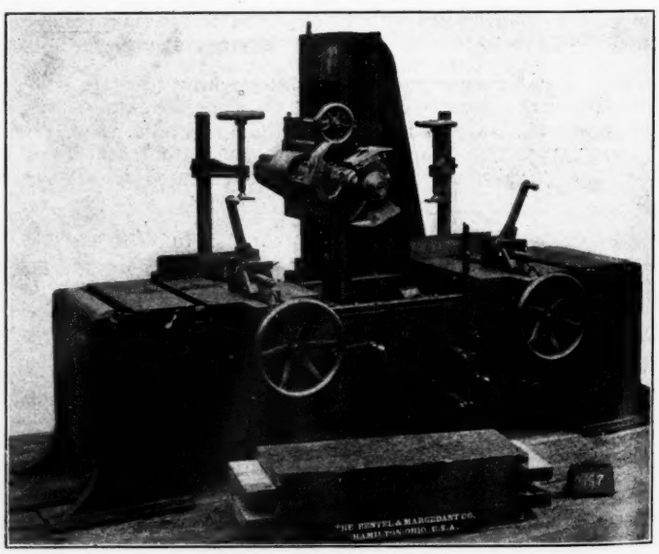
The Bentel Morgandant Co., Hamilton, Ohio, has developed, since its establishment in 1864, a full line of wood-working tools for railway car shops; we illustrate two of its latest tools for heavy work on car sills.

The hollow chisel mortising machine has a radial boring



Hollow Chisel Car Mortiser.

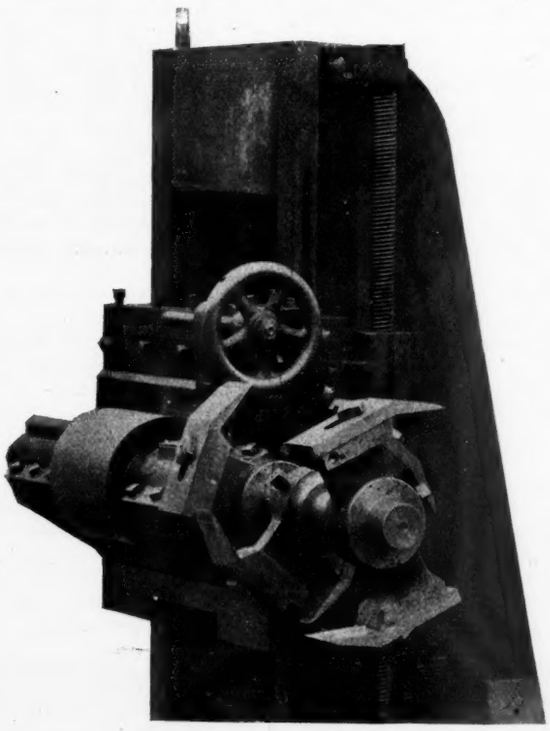
spindle and it is built with long traveling carriage up to 40 ft. long. The main housing requires no counterbalance and works quickly and easily in either direction. The table is built so as to be rigid for the heaviest timbers. It will clamp material 20 in. x 16 in., is provided with quick-acting clamps, and has



Automatic Vertical Car Tenoner.

both power and hand feed. The chisel ram, 29 in. long, is mounted on the front of the housing in the dove-tailed slides, and is counterbalanced so as to take all weight from the working mechanism. The chisel ram has 17-in. vertical movement and 16-in. transverse movement, mortising 6 in. deep.

The cutting speed of the chisel is 13 ft. per minute, with the return double this speed. The radial boring attachments can be used either on one side, as shown, or on both sides, or may be omitted. They have 20-in. vertical adjustment, 6-in. transverse adjustment, and an angular movement of 30 deg. either way. The machine requires 15 to 20 h.p.



Detail of Car Tenoner.

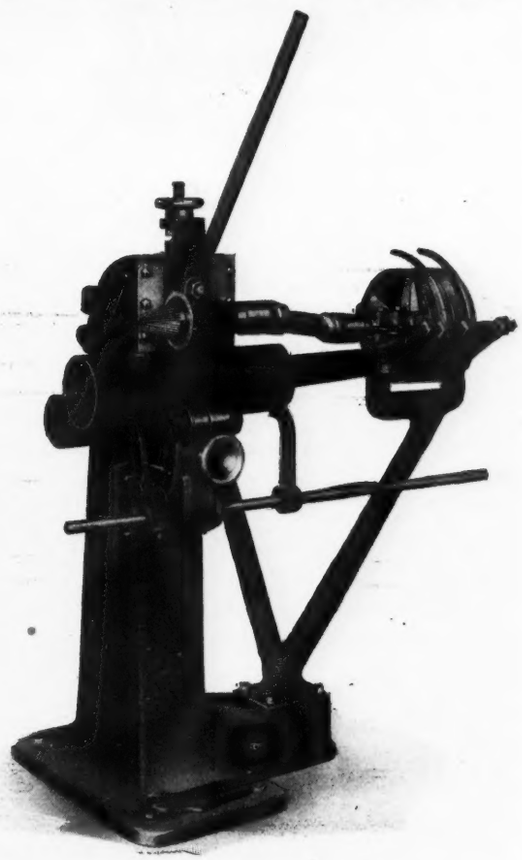
The automatic vertical car tenoner is the latest improved heavy pattern. It is intended for making single, double or triple tenons on the ends of long sills from one face without reversing the material. It is supplied with special shaped knives, which may be used for cornering, beveling, rabbeting or cutting down the sides of timber, using it as a planer. In this way it can finish the ends of timbers to any desired shape. The clumsy and heavy counterbalance for the housing is dispensed with, the feed motion being strong enough to raise the heads without a counterbalance. The machine is fitted with a power feed arrangement consisting of two vertical screws geared together with miter gearing, and the power is applied by friction wheels. The cutter heads, three in number, are made of steel, are 13 in. in diameter, and are capable of quick adjustment for different thicknesses of tenons. The lumber supporting table is 8 ft. 5 in. long, provided with a dividing gap for the passage of the cutter heads. The table is provided with two short sectional clamps which receive motion through rack and pinion feed, operated by a hand wheel at the front of the machine. Each section is provided with a stop to gage the length of the tenon, which quickly drops out of the way and is controlled by the crank lever at the front of the machine. The machine requires about 15 h.p.

Ryerson Flue-Cutting Machine.

There has long been a demand for a good substantial machine for cutting pipe or tubes, of sufficient capacity to handle the general range of work, designed in such a way as to occupy a small amount of floor space and simple enough in its operation to permit of its being run by unskilled men. Joseph T. Ryerson & Son, Chicago, have placed on the market the machine shown in the accompanying illustrations. This machine is now in use in a number of the leading shops. The Ryerson flue-cutting machine, which is claimed to be practically noiseless in operation, has a capacity for cutting tubes or pipes from ⅜ in. to 6 in. in diameter. It is arranged so that the work may be cut off any desired length, and is rapid in operation.

The cutter wheel is direct connected by a knuckle joint shaft to a 12-in. x 3-in. pulley which should run at about 200

Side View; Ryerson Flue Cutting Machine.



Front View; Ryerson Flue Cutting Machine.

r.p.m. The object of the knuckle joint drive is to permit the tubes or pipes to be run out back of the machine so that they may be cut to any length. The feed of the cutter is accomplished by the hand lever shown, a balance weight being provided to secure an automatic release. The lever is so balanced that it requires but little pull on it to cut tubes of any size. The rollers on which the tubes revolve are arranged so they can be brought close together or spread apart quickly to the proper distance for taking care of the various sizes of tubes or pipe.

For reaming out the slight burr from the inside of the tube, which is sometimes caused by the cutting wheel, a fluted reamer is provided and attached to the end of the shaft, as shown in the cut. This reamer will ream tubes up to and including 3 in. in diameter. When desired a larger reamer for tubes of greater diameter can be furnished to be attached to the opposite end of the shaft, just outside of the end bearing box.

Each machine is furnished complete with one cutter wheel 4½ in. in diameter, and a fluted reamer for handling tubes up to 3 in. in diameter, and all necessary wrenches. It weighs about 825 lbs.

Lodge & Shipley Shops.

The Lodge & Shipley Machine Tool Co., Cincinnati, Ohio, is the largest builder of lathes in the world, and at present the shops are being worked to full capacity. The photograph shown herewith is a fair representation of the constant flow of lathes through the large shop. In addition to differences as to size, there is distinct division as to the method of drive in this movement of the lathes, all the belt-driven machines being on one side of the main aisle, and the motor-driven lathes being on the other side.

The erecting shop has been rebuilt recently, making it one story instead of two stories. The drawing shows a cross section of this bay, which is 90 ft. x 650 ft. It is of brick and steel and is fireproof. The main machine shop is 60 ft. x 250 ft., of similar construction, and is two stories high. There are also separate buildings containing the pattern shop, screw and machine departments, power house, and a large warehouse, making a total of 130,000 sq. ft. of floor space. The shops are equipped with modern power appliances and the main bays are fitted with electric traveling cranes. This large establishment is devoted entirely to the manufacture of lathes up to 48 in., and some large lathes for the government navy yards have been made here recently.

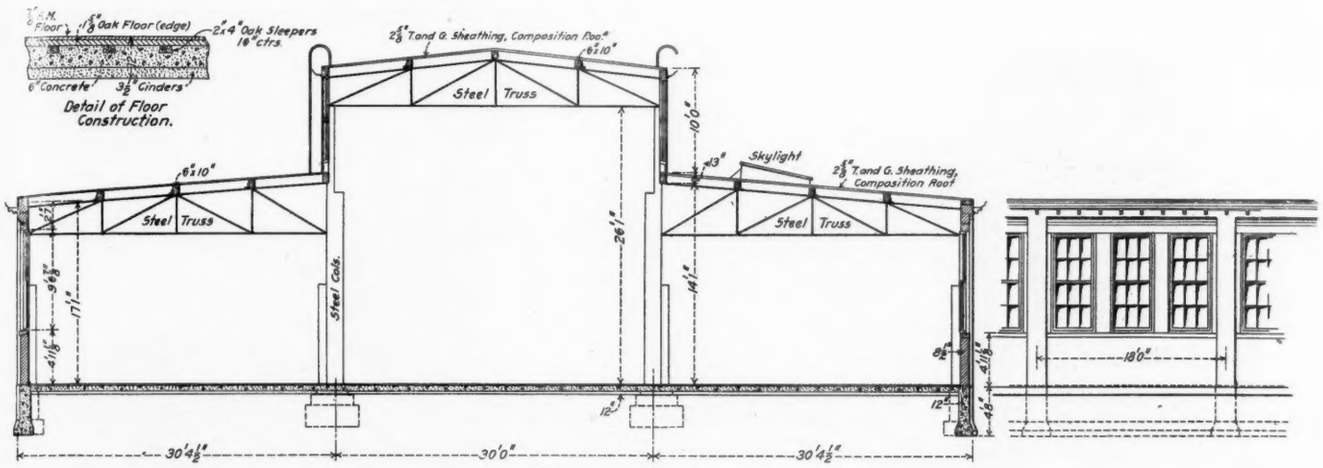
The motor-driven 24-in. lathe which is here illustrated embodies the various improvements which have been made by Lodge & Shipley in lathe manufacture. One of the principal details in this improvement is the patent head stock, which is intended to take advantage of the increased efficiency of high-speed steel and is the result of several years' experimenting with various devices for providing more power than is possible with the ordinary type of cone pulley.

This new head stock includes the following important features: First, an open belt speed is provided for small diameters in finishing cuts; second, the spindle bearing, on which the accuracy of the lathe depends, is relieved of belt pull; third, more force at the cutting edge is secured by the use of wider belts instead of through high gear ratios; fourth, the design is such as to

Lodge & Shipley Erecting Shop.

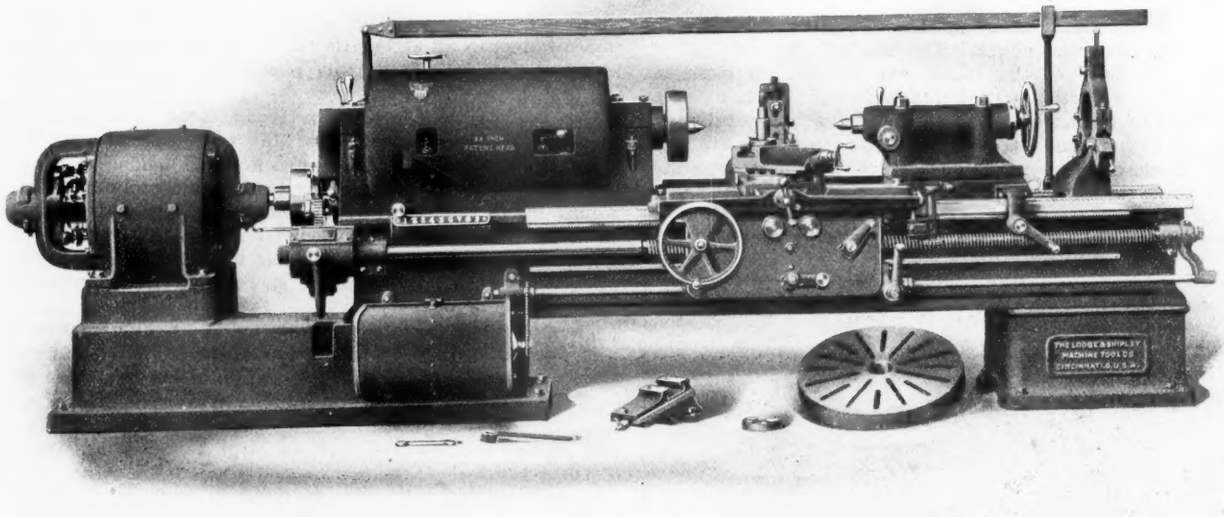
furnish proper back gear roughing speed on small diameters; fifth, speed changes are made without the necessity of shifting belts; sixth, the lubrication of the bearing is automatic and positive. The power is applied with a wide face pulley of large diameter, which is keyed to a sleeve revolving in two central bearings on the head stock.

At one end of this sleeve is the driving mechanism of the jaw clutch cut from the solid. The sleeve also supports the two driving gears for the back gear speeds. The lathe spindle passes through this sleeve without touching it, having about ⅛ in. clearance, and revolves in two outer bearings. The pull of the belt is, therefore, taken by the two central bearings and the belt strain is not communicated to the spindle. It is thus relieved of all wear due to belt pull. By means of the broad belt sufficient force is obtained for heavy cuts through a moderately high back gear ratio. The back gear is designed for ratios that give a uniform speed progression. The end thrust of the spindle is taken against the rear spindle housing by a large iron collar keyed fast to the spindle, and the bearing surfaces are bronze washers on either side of steel washers. The larger lathes have a central rib or brace of box section running parallel to the walls of the lathes. In the top of this rib is cast a rack, with which a pawl on the back of the tail stock engages. A positive brace to the latter is thus provided, preventing the backing off of the tail stock and relieving the bolts when the lathe is engaged on heavy work. The carriage and apron have also received careful attention in design and embody all improved principles required by up-to-date lathes. The screw cutting and feed features of the lathe have many points of excellence, among which are extreme simplicity, rigidity and compactness. All motion is transmitted directly through gears, and the location of the change gears between the walls of the bed protect them from flying chips or dirt and does away with the unsightly gear box usually placed in front of the lathe bed on other types of lathes.



Section Through Erecting Floor of Machine Shop; Lodge & Shipley.

In the motor-driven lathes, the advantage of having no pull on the spindle is retained, since the main driving gear takes the place of the driving pulley on the sleeve, and the lathe spindle receives none of the thrusts from the main driving gears. The motor is mounted on an extended cabinet leg and connected to the lathe spindle through gearing at the back of the head stock. It is thus placed in position to be readily accessible to the operator and to obviate the top-heaviness and vibration incident to the usual custom of mounting it on top of the head stock. The illustration shows the lathe as driven by a 10-h.p. variable speed motor at 450 to 900 r.p.m. There are six mechanical speed changes in the head stock, and on the triple-geared lathe there are ten mechanical changes, or 200 changes with a 20-point controller.



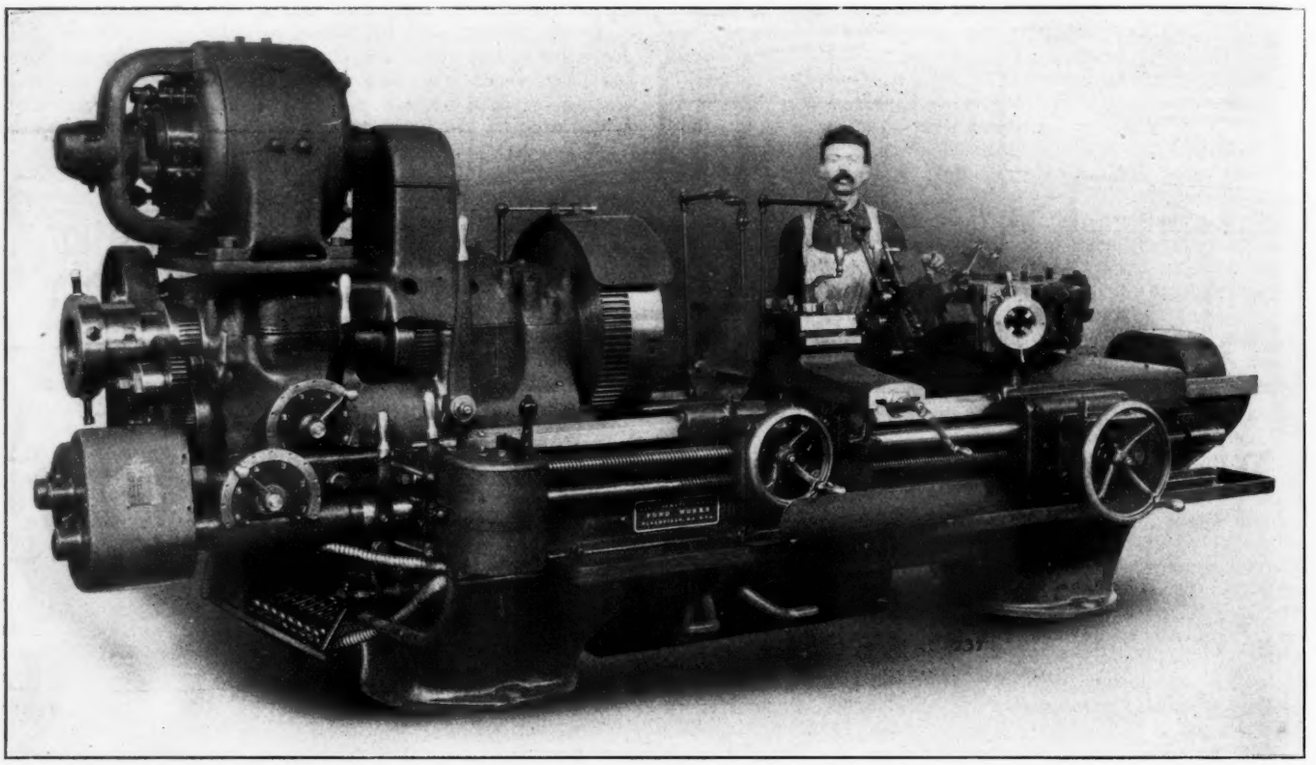
Motor-Driven 24-in. Lathe; Lodge & Shipley.

Pond Rigid Turret Lathe.

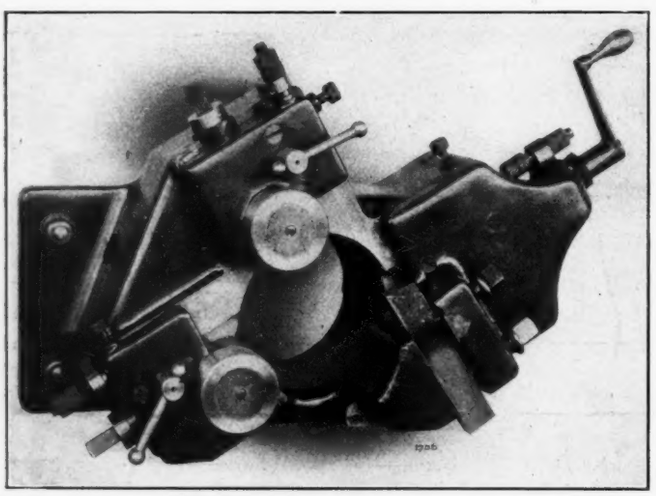
The 28-in. Pond rigid turret lathe is a heavy and powerful tool, the latest type of heavy Pond turret lathe for locomotive repair shop use. The compact design and great weight make it adaptable for heavier work than is usually done on this class of turret lathes. The illustration shows the lathe as driven by a 10 h.p. motor; when desired, the same tool is furnished with an 8-in. pulley for constant speed drive by belt. The swing over the carriage is 24½ in. and the travel of turret 5 ft. The lathe is equipped with a 24-in., three-jawed, geared scroll, universal chuck. The size of the carriage is such that the faces of the turret can be run up close to chuck. This is a particularly desirable feature, as it reduces the overhang of boring bars and facing heads to a minimum. Six changes of independent feed, instantly adjustable, are provided for both carriage and turret, each having a separate lead screw so that the work can be turned while boring is being done.

All the speeds are controlled by convenient handles through the geared head. The feed for the carriage and turret is entirely independent through separate lead screws. The carriage is arranged to run underneath the chuck so as to allow the turret to be brought close to the chuck.

The lathe has liberal pans around the bed to catch oil, and the oiling devices provide a liberal supply of oil for both the carriage and the turret. For holding the bar there is a geared scroll chuck with auxiliary jaws, as this type of chuck will hold rough forgings. In most locomotive repair shops crank pins and such work are made from old axles, re-forged.



Pond Rigid Turret Lathe.



Universal Turner with Roller Back Rest.

They are not of uniform diameter and cannot be handled to advantage in an automatic chuck without first being turned in an engine lathe; for this reason the universal chuck is the best.

The turret has three extra broad faces, particularly applicable for clamping large turning tools and forming tools, while the narrow faces are useful for drill holders, die heads, etc. The turret is of especially heavy construction. It is revolved by power; otherwise it could not be made as heavy as it is. It also has rapid power traverse backward and forward. The turret tools are similar to those which have been worked out so carefully for the smaller bar turret lathes, and have over-shot cutters.

The detail illustration shows the large universal turner with roller back rest, which is furnished with this lathe. This turner has easy and wide adjustment, and the roller back rests enable turning to be done at a much higher speed than is possible with solid back rests. This is nearly the only turner of this type used on large turret lathes in place of box tools.

A machine of this type is used on such work as large washers, bushings, knuckle joint pins, wrist pins, etc., and it is also applicable to a large variety of chucking work, such as valves, piston rings for piston valves and covers for piston valves. In turning pins it is customary to get them out in large quantities on a turret lathe, leaving the fits about one thirty-second large, as it cannot be determined beforehand to what diameter the holes will have to be reamed. It is a small item to take a pin from the store and finish it in an engine lathe to the correct diameter, and for this purpose the pins are centered in a turret lathe before cutting off.

The machine is built by the Niles-Bement-Pond Co., New York.

ANNUAL REPORT

SOUTHERN PACIFIC COMPANY AND PROPRIETARY COMPANIES—TWENTY-FIFTH ANNUAL REPORT.

INCOME FOR THE YEAR.

The gross receipts and disbursements of the Southern Pacific Company in respect of its leased lines and of the Proprietary Companies in respect of lines not leased, and the other receipts and disbursements of the Southern Pacific Company and of such Proprietary Companies, after excluding all offsetting transactions between them, were as follows:

Applied as follows:	
Construction and acquisition of new lines, additions, betterments and other property	$36,643,008.05
Payments to sinking and trust funds	382,607.04
Advances for closing Colorado River crevasse	251,713.71
Increase in contingent assets	414,993.04

	Year ended June 30, 1909.	Year ended June 30, 1908.	+ Increase, or —Decrease
Average miles of railway operated—proprietary and non-proprietary	9,626.43	9,505.61	+ 120.82
TRANSPORTATION OPERATIONS.			
Gross operating revenues	$110,846,404.46	$113,545,566.52	—$2,699,162.06
Outside operations—revenues	9,675,504.28	9,731,354.25	— 55,849.97
Total	$120,521,908.74	$123,276,920.77	—$2,755,012.03
Operating expenses	$67,191,874.66	$76,005,494.05	—$8,813,619.39
Outside operations—expenses	8,604,258.34	8,657,557.84	— 53,299.50
Taxes (rail lines and properties dealt with as outside operations)	3,788,242.14	3,950,140.02	— 161,897.88
Total	$79,584,375.14	$88,613,191.91	—$9,028,816.77
Revenues over expenses and taxes	$40,937,533.60	$34,663,728.86	+$6,273,804.74
INCOME OTHER THAN FROM TRANSPORTATION OPERATIONS.			
Interest on bonds owned of Southern Pacific Co. and of Proprietary Cos.	$893,645.39	$1,033,081.67	— $139,436.28
Interest on bonds owned of companies other than Proprietary Companies	867,711.80	824,758.72	+ 42,953.08
Dividends on stocks owned by companies other than Proprietary Companies	992,492.22	1,065,759.68	— 73,267.46
Income from lands and securities not pledged for redemption of bonds	821,858.12	729,366.50	+ 92,491.62
Income from sinking funds pledged for the redemption of bonds	205,800.00	181,531.85	+ 24,268.15
Balance of interest received on loans and of interest accruing to June 30, on open accounts other than with Proprietary Companies	1,430,663.96	124,148.61	+ 1,306,515.35
Miscellaneous income	60,177.50	35,101.30	+ 25,076.20
Total	$5,272,348.99	$3,993,748.33	+$1,278,600.66
Surplus	$46,209,882.59	$38,657,477.19	+$7,552,405.40
FIXED CHARGES.			
Interest on outstanding funded debt of Southern Pacific Co. and Proprietary Companies	$17,196,370.39	$16,103,960.75	+$1,092,409.64
Sinking fund contributions and income from sinking fund investments	572,800.00	548,531.85	+ 24,268.15
Hire of equipment—balance	404,051.30	874,614.05	— 470,562.75
	$18,173,221.69	$17,527,106.65	+ $646,115.04
Less rentals for lease of road, for joint tracks, yards, and other facilities, viz.:			
Collections $865,187.45			
Payments 335,562.56	529,624.89	257,492.38	+ 272,132.51
	$17,643,596.80	$17,269,614.27	+ $373,982.53
Total, fixed charges	$28,566,285.79	$21,387,862.92	+$7,178,422.87
Surplus over fixed charges			
OTHER CHARGES.			
Land department expenses	$103,286.95	$110,788.64	— $7,501.69
Taxes on granted and other lands	246,181.00	233,836.15	+ 12,344.85
Miscellaneous expenses	54,934.68	26,991.72	+ 27,942.96
Taxes and other expenses of Southern Pacific Company	414,668.92	270,098.98	+ 144,569.94
Additions and betterments payable from income of Southern Pacific Company	503,847.75	282,952.06	+ 220,895.69
Reserve for depreciation of rolling stock owned by Southern Pacific Company and leased to other companies	363,964.08	585,454.76	— 221,490.68
Total other charges	$1,686,883.38	$1,510,122.31	+ $176,761.07
Surplus over fixed and other charges	$26,879,402.41	$19,877,740.61	+$7,001,661.80

ASSETS AND LIABILITIES.

The details of the assets and liabilities of the Southern Pacific Company are shown in Table No. 11.

The resources of the Southern Pacific Company and Proprietary Companies for the year, and the disposition made thereof (excluding offsetting accounts between them), briefly stated were as follows:

Cash on hand July 1, 1908		$6,145,731.90
Received from issue of new securities	$107,230,947.71	
Deduct securities retired	13,247,308.22	93,983,639.49
Proceeds from sale of treasury securities	$20,337,688.41	
Deduct stocks and bonds purchased	8,102,397.41	12,235,291.00
Equipment sold to Proprietary Companies		8,154,444.18
Decrease in material and supplies on hand		2,130,279.86
Collection of current cash assets		3,477,339.56
Increase in current cash liabilities		2,571,927.01
Increase in reserve funds and other contingent liabilities		238,662.54
Gross operating revenues	$120,521,908.74	
Interest, dividends and other collections	8,758,971.80	
Total revenue	$129,280,880.54	
Deduct operating expenses, taxes, fixed charges, and other income charges	98,979,316.77	30,301,563.77
Total resources for the year		$159,238,879.31

Dividends on preferred and common stocks	$17,336,974.74	
Discount on capital issues during the year and other profit and loss charges	8,095,937.06	
Loans paid off	52,472,648.26	
Loaned on demand and on time deposits	11,450,000.00	
		$127,047,881.90
Balance—Cash on hand June 30 1909		32,190,997.41
		$159,238,879.31

The stocks and bonds of the Southern Pacific Company and of the Proprietary Companies, outstanding June 30, 1909, are held as follows:

	Common stock.	Preferred stock.	Bonds and other fixed interest bearing obligations.
Stocks and bonds of Southern Pacific Company	$213,910,358.64	$58,626,765.00	$119,555,045.71
Deduction: Deposited under S. P. Co. 2-5 years 4 per cent. mortgage			$1,835,000.00
Free in treasury	$137,953.34		14,000.00
Held by Sinking Funds for redemption of bonds			1,715,000.00
Total deductions	$137,953.34		$3,564,000.00

	Common stock.	Preferred stock.	Bonds and other fixed interest bearing obligations.
Amount outstanding in hands of the public.	$213,772,405.30	$58,626,765.00	$115,991,045.71
Stocks and bonds of Proprietary Companies.	$309,816,272.00	$25,800,000.00	$358,912,812.88
Deductions: Deposited against issue of Southern Pacific Company common stock and bonds....	$275,904,333.00	$25,780,000.00	$10,714,000.00
Owned by Southern Pacific Co. free....	33,497,065.50	11,000.00	1,943,000.00
Owned by Proprietary Companies.	349,500.00	.....	694,500.00
Held by Sinking Funds for redemption of bonds	.....	.....	11,924,000.00
Total deduction	$309,750,898.50	$25,791,000.00	$25,275,500.00
Amount outstanding in hands of the public.	$65,373.50	$9,000.00	$333,637,312.88
Total stocks and bonds of Southern Pacific Co. and of Proprietary Companies outstanding in the hands of the Public	$213,837,778.80	$58,635,765.00	$449,628,358.59

The details of the stocks and bonds owned by the Southern Pacific Company (pledged or free) are shown in Tables Nos. 12 and 13.

The Southern Pacific Co. has in its treasury Two-Five Years Four Per Cent. Gold Bonds to the amount of $17,524,000, not included in any statement of outstanding bonds for which the collateral securities are deposited with the Trustee to secure the payment of these bonds.

The combined assets and liabilities of the Southern Pacific Company and the Proprietary Companies, other than capital assets and liabilities (excluding offsetting accounts between them) were as follows:

Current and Deferred Assets.	Total June 30, 1909.	Total June 30, 1908.	Increase, *or Decrease.*
Cash	$32,190,997.41	$6,145,731.90	$26,045,265.51
Demand loans and time deposits	11,450,000.00	.....	11,450,000.00
Cash accounts	13,288,462.55	16,765,802.11	*3,477,339.56*
Material, fuel and other supplies	13,094,643.32	15,224,923.18	*2,130 279.86*
Advances for construction and acquisition of new lines, including electric lines	84,073,969.29	61,146,399.18	22,927,570.11
Terminal real estate and other property	17,349,958.96	15,860,787.15	1,489,171.81
Rolling stock and floating equipment	18,170,954.45	26,325,398.63	**8,154,444.18*
Advances for closing Colorado River crevasse.	3,769,866.36	3,518,152.65	251,713.71
Total Current and Deferred Assets	$193,388,852.34	$144,987,194.80	$48,401,657.54
Current and Deferred Liabilities.			
Loans and bills payable..	$150,000.00	$52,622,648.26	*$52,472,648.26*
Interest and dividends..	16,122,637.53	15,356,105.72	766,531.81
Other cash accounts ...	11,958,366.77	10,769,812.78	1,188,553.99
Deferred liabilities	1,675,561.19	1,058,719.98	616,841.21
Total Current and Deferred Liabilities ..	$29,906,565.49	$79,807,286.74	*$49,900,721.25*
Assets in excess of liabilities	$163,482,286.85	$65,179,908.06	$98,302,378.79
Contingent assets.....	$4,935,697.98	$4,520,704.94	$414,993.04
Contingent liabilities, viz.:			
Insurance, replacement and depreciation funds provided for by deductions from revenues and by charges to operating expenses	$5,052,632.64	$4,960,196.30	$92,436.34
Reserves for replacement and depreciation of floating equipment and rolling stock	6,534,446.17	7,749,574.19	*$1,215,128.02*
Principal of deferred payments on land contracts	374,178.88	483,416.08	*109,237.20*
Fund for refunding outstanding old bonds of Southern Pacific R. R. Co.	973,452.88	.....	973,452.88
Unadjusted claims and accounts	3,497,849.96	3,000,711.42	497,138.54
	$16,432,560.53	$16,193,897.99	$238,662.54

Note.—Decreases shown in *italics.*

*Free equipment of Southern Pacific Company sold to Proprietary Companies.

CAPITAL EXPENDITURES.

The expenditures by the Proprietary Companies for the construction of new lines, for additions and betterments to completed lines, and for equipment, charged to capital account, were as follows:

Expenditures for new lines, viz.:		
Galveston, Harrisburg and San Antonio Railway:		
Surveys of new lines.....		$1,657.66
Houston and Shreveport Railroad:		
Surveys of new lines.....		3,061.17
Houston and Texas Central Railroad:		
Extension from Mexia to Nelleva	$10,596.38	
Real estate.....	409.75	
		11,006.13
Louisiana Western Railroad:		
Extension from Eunice to Mamou.....	$2,195.57	
Settlement of old construction claims, completed lines.....	155.65	
		2,351.22
Morgan's Louisiana and Texas Railroad and Steamship Co.:		
Extension from Lafayette to Port Allen	$286,050.58	
Extension from Bayou Sale to S. Bend	15,409.13	
		301,459.71
Southern Pacific Railroad:		
Extension—Wyo. East.....	$23.66	
Exten. from Tres Pinos to Lime Rock	19,823.42	
Extension from Benedict to Smeltzer..	104,197.48	
Extension from Empire to Rossi.....	168,380.20	
Extension of San Ramon Branch.....	312,509.16	
Extension of Fresno Branch to Famosa.	11,185.06	
Extension from Araz to Laguna Dam..	85,164.14	
For 137 locomotives and 15 baggage, 10 baggage and express, 15 dining, 134 chair, 27 passenger, 4,637 freight and 49 road service cars.....	7,013,598.02	
		7,714,881.14
Texas and New Orleans Railroad:		
Extension from Gallatin to Rusk.....	$141,534.72	
Extension to Port Arthur.....	3,502.12	
		145,036.84
Expenditures for Additions and Betterments, viz.:		
Roadway, Track and Appurtenances:		
Ballast	$102,494.76	
Bridges, trestles, culverts, and grade crossings	458,018.54	
Changes in line revision of grades, widening embankments, and tunnel improvements	583,784.74	
Electric power transmission.....	388,478.13	
Interlocking, block, and highway crossing signals.....	401,453.90	
Main tracks.....	1,213,755.72	
Real estate, right of way and grounds, and fencing right of way.....	61,958.08	
Sidings, and passing tracks.....	483,434.23	
Telegraph and telephone lines.....	28,410.34	
		$3,721,788.44
Buildings, Structures, and Appurtenances:		
Engine houses, shops, machinery, tools, etc.	$217,057.70	
Roadway buildings, machinery, tools, etc.	42,401.20	
Station buildings, terminal yards, and appurtenances	611,312.35	
Water stations, and water supply.....	111,028.82	
		981,800.07
Equipment:		
100 box cars.....	$109,823.22	
Floating equipment in course of construction	134,326.92	
Additions and improvements to existing equipment	25,984.90	
Cost of equipment charged to replacement accounts in excess of the amounts to the credit of the several replacement accounts.....	23,669.79	
		293,804.83
Total. Additions and Betterments.....		$4,997,393.34
Less credits.....		181,486.27
		$4,815,907.07
Less expenditures paid from income of Southern Pacific Company, viz.:		
South Pacific Coast Railway.....	$405,276.78	
New Mexico & Arizona Railroad.....	64,469.12	
Sonora Railway	34,101.85	
		503,847.75
		$4,312,059.32
Total capital expenditures		$12,491,513.19
Deductions:		
Proceeds from sale of real estate.....	$28,357.92	
Proceeds from sale of rock and other collections	5,121.63	
Miscellaneous collections.....	14,925.86	
Surveys written off and other adjustments	6,635.92	
Change of line, Palisade, Nev.....	10,205.73	
	$65,247.06	
Net expenditures for capital account of Proprietary Companies.....		$12,426,266.13

The two Mallet compound locomotives, consolidation type, added during the year averaged 213 tons total weight of engine without tender and 197 tons upon drivers, but there were added six 8-wheel locomotives, averaging 54.60 tons total weight of engine without tender and 36.70 tons upon drivers, which reduced the average for locomotives added during the year to 94.70 tons total weight of engine without tender and 76.28 tons upon drivers.

EQUIPMENT.

The changes in equipment during the year were as follows:

	Condemned, destroyed, sold or transferred and credited to replacement accounts.	Added and charged to: Replacement Accounts.	Capital Account.	Free assets So. Pac. Co.	Total.
Locomotives	45	29	137	*158	8
Baggage cars	3	..	25	*19	6
Baggage and mail cars	1	8	..	14	22
Baggage and passenger cars	..	2	..	..	2
Baggage, mail and passenger cars	2	..	..	..	..
Business cars	3	..	..	..	..
Chair	..	..	134	*134	..
Composite	1	8	..	..	8
Dining cars	..	3	15	*16	2
Instruction	..	1	..	..	1
Motor (gasolene)	..	..	..	15	15
Observation cars	..	2	..	2	2
Passenger cars	40	22	27	*41	8
Narrow gauge passenger-train cars	1	..	..	..	..
Box cars	1,480	428	1,170	287	1,885
Caboose cars	9	15	..	4	19
Flat cars	621	459	1,357	*1,143	673
Fruit cars	20	..	..	..	..
Furniture cars	4	1	210	*210	1
Gondola cars	149	10	115	*65	60
Gondola cars (drop bottom)	..	300	..	40	340
Gondola cars (hopper bottom)	20	136	..	*135	1
Refrigerator cars	5	..	69	*69	..
Stock cars	53	200	687	*687	200
Tank cars	42	251	1,143	*1,393	1
Narrow gauge freight-train cars	31	4	..	..	4
Work equipment	533	783	49	222	1,054
Amount credited or charged	$2,096,085 30	$2,413,629 36	$7,135,519 56	†$8,166,759 27	$1,382,389 65

*Sold by Southern Pacific Company to Proprietary Companies. †Credit.

There remained to the credit of the respective replacement accounts at the close of the year an aggregate of $511,441.98.

The locomotives and cars owned, and their capacity at the close of the year were as follows:

	This year.	Last year.	Increase or *decrease.*	Per cent.
Locomotives, standard gauge	1,822	1,858	*36*	1.94
" narrow gauge	15	16	*1*	6.25
Total	1,837	1,874	*37*	1.97
(Standard Gauge.)				
Total wt., excluding tenders—tons	131,565	132,147	*582*	.44
Av. total wt., excldg. tenders—tons	71.62	71.12	.50	.70
Total weight on drivers—tons	108,013	108,588	*575*	.53
Av. total weight on drivers—tons	58.80	58.44	.36	.62
Passenger-train cars, standard gauge	1,736	1,722	14	.81
" " " narrow gauge	35	36	*1*	2.78
Total	1,771	1,758	13	.74
Freight-train cars, standard gauge	44,188	43,411	777	1.79
" " " narrow gauge	390	417	*27*	6.47
Total	44,578	43,828	750	1.71
Total capacity of standard gauge cars—tons	1,632,708	1,532,194	100,514	6.56
Average capacity of standard gauge cars—tons	37.58	35.90	1.68	4.68
Work equipment, standard gauge	5,375	4,850	525	10.83
" " narrow gauge	23	27	*4*	14.81
Total	5,398	4,877	521	10.68

Decreases shown in *italics.*

TRANSPORTATION OPERATIONS.

The results of the year's transportation operations compared with those of the preceding year are as follows:

	This year.	Last year.	Inc. or *Dec.* Pr. ct.
Av. miles of railway operated	9,626.43	9,505.61	1.27
REVENUES:			
Passenger, including extra baggage	$34,345,339 36	$35,800,592 45	*4.06*
Mail, and express	4,628,261 29	4,820,614 18	*3.99*
Freight	69,878,880 14	71,073,567 61	*1.68*
Switching, rentals, and all other sources	1,993,923 67	1,850,792 28	7.73
Total rail lines	$110,846,404 46	$113,545,566 52	*2.38*
Outside operations—revenue	9,675,504 28	9,731,354 25	*.57*
Total revenues	$120,521,908 74	$123,276,920 77	*2.23*
OPERATING EXPENSES:			
Maintenance of way and structures	$14,533,135 25	$17,083,235 79	*14.93*
Maintenance of equipment	14,379,762 48	15,439,095 44	*6.86*
Traffic expenses	2,069,939 51	2,160,430 48	*4.19*
Transportation expenses	32,846,193 00	37,804,200 58	*13.11*
General expenses	3,362,844 42	3,518,531 76	*4.42*
Total rail lines	$67,191,874 66	$76,005,494 05	*11.59*
Outside operations—expenses	8,604,258 34	8,657,557 84	*.62*
Total expenses	$75,796,133 00	$84,663,051 89	*10.47*
Gross revenues over total expenses	$44,725,775 74	$38,613,868 88	15.83

	This year.	Last year.	Inc. or *Dec.*, Pr.ct.
PASSENGER TRAFFIC:			
Revenue passengers carried	$39,337,735	$41,393,734	4.97
Revenue passengers carried one mile	1,541,212,518	1,640,036,373	*6.02*
Revenue from passenger trains per mile of road (a)	$3,961 01	$4,175 84	*5.14*
Revenue from passenger trains per *revenue train* mile (a) (b)	$1.84	$1.94	*5.15*
Average revenue per passenger per mile	*2.185	*2.174	.50
Average distance carried	†39.18	†39.62	*1.11*
FREIGHT TRAFFIC:			
(Way-bill Tonnage.)			
Tons of revenue freight carried	22,713,143	22,840,404	*.56*
Tons of revenue freight carried one mile	6,055,858,314	6,486,220,688	*6.64*
Ton miles per mile of road—revenue freight (a)	629,087	682,357	*7.81*
Revenue per mile of road (a)	$7,121 07	$7,333 27	*2.89*
Revenue per *revenue train* mile (a) (c)	$4 38	$3 59	22.01
Average receipts per ton per mile—revenue freight	*1.154	*1.097	5.20
Average distance carried—all freight	†256.52	†270.53	*5.18*

(a) Based on traffic over rail lines only, length of ferries used between rail stations excluded in distance over which traffic was moved.

(b) Revenue passenger train and *all* mixed train miles, but excluding mileage of locomotives helping.

(c) Revenue freight train and *all* mixed train miles, but excluding mileage of locomotives helping.

* Cents. † Miles.

Decreases shown in *italics.*

Compared with the preceding year, the per cent. of operating expenses (including expenses of outside operations) to the gross revenues (including those from outside operations) was as follows:

	Rail Lines only.	Rail Lines and Outside Operations.
For "Maintenance" (*Maintenance of Way and Structures, and Mainten. of Equipment*)	26.08	
For "Operation" (*Traffic Expenses, Transportation Expenses, and Gen. Expenses*)	34.53	
Total this year	60.61	62.89
Total last year	66.94	68.68

There was a decrease in the operating expenses for the half-year ended December 31, 1908, of $9,120,617.70, but, in the second half-year ended June 30, 1909, the operating expenses increased $253,698.81, a net decrease for the year of $8,866,918.89, or 10.47 per cent. The decrease in expenses for the first half-year resulted from a diminution in the amount of traffic moved and from the economies put into effect during the business depression of the preceding year. A considerable saving in expenses was also effected by the reduction in locomotive mileage—the result of better train loading.

In the following statements, the operating expenses, distributed as provided for in the classification of the Interstate Commerce Commission, have been combined under comprehensive titles of accounts so as to present the year's results in a concise form:

MAINTENANCE OF WAY AND STRUCTURES.

	This Year.	Last Year.	Increase. or *Decrease.*	Per Cent.
Average miles—first and additional main tracks	9,858.22	9,700.22	158.00	1.63
Ballast	$171,831.84	$294,686.86	*$122,855.02*	—41.69
Ties	2,065,206.05	2,760,790.43	*695,584.38*	—25.20
Rails	1,294,691.11	511,313.77	783,377.34	+153.20
Frogs, switches, and other track material	1,414,415.24	1,479,143.79	*64,728.55*	—4.38
Total material roadway and track	$4,946,144.24	$5,045,934.85	*$99,790.61*	—1.98
Repairs of roadway and track	5,419,665.25	6,747,648.36	*1,327,983.11*	—19.68
Bridges, trestles, and culverts	1,177,362.39	1,435,192.79	*257,830.40*	—17.96
Buildings, grounds, and appurtenances	1,876,373.58	2,433,543.70	*557,170.12*	—22.90
Snow and sand fences, and snow sheds	130,954.91	275,189.29	*144,234.38*	—52.41
Electric power, telegraph, and telephone lines	165,997.75	204,974.79	*38,977.04*	—19.02
Superintendence	726,198.93	826,398.75	*100,199.82*	—12.12
Stationery and printing	29,200.02	34,742.80	*5,542.78*	—15.95
Other expenses	61,238.18	79,610.46	*18,372.28*	—23.08
Total	$14,533,135.25	$17,083,235.79	*$2,550,100.54*	—14.93
Cost per mile—all main tracks	$1,474.21	$1,745.96	*$271.75*	—15.56

Decreases shown in *italics.*

The following rails, ties, tie plates and continuous rail joints were used in making renewals, and the entire cost thereof charged to operating expenses:

	This Year.	Last Year.	+ Increase. — Decrease.
Miles of new steel rails	541.07	303.80	+ 237.27
Per cent. of renewals of all rail in track, including sidings	4.14	2.37	+ 1.77
Number of burnettized ties	1,551,217	1,234,890	+ 316,327
Number of other ties	1,726,175	2,713,718	— 987,543
Total number of ties	3,277,392	3,948,608	— 671,216
Equal to miles of continuous track	1,162.31	1,410.22	— 247.91
Per cent. of renewals of all ties in track, including sidings	8.89	11.01	— 2.12
Number of tie plates	4,071,970	3,053,358	+ 1,018,612
Equal to miles of continuous track	722.05	545.24	+ 176.81
Number of continuous rail joints	349,306	276,100	+ 73,206
Equal to miles of continuous track	496.17	392.19	+ 103.98

The weight of rails per yard in main line and branches at the close of the year was as follows:

Miles of main and second track operated, excluding mileage operated under trackage rights.	Total.	141-lb.	96-lb.	90-lb.	80-lb.	76-lb.	75-lb.	70-lb.	65-lb.	61.5 and 60-lb.	56-lb.	54-lb.	52-lb.	50-lb. and less than 50-lb.
Main and second track	5,573.64	1.11	20.56	252.28	2,809.95	91.81	2,261.30	....	....	110.65	.98	....	....	25.00
Branches	4,313.81	.65	.38	....	105.12	95.22	423.13	10.72	67.29	1,670.29	237.84	231.68	88.72	1,382.77
Total	9,887.45	1.76	20.94	252.28	2,915.07	187.03	2,684.43	10.72	67.29	1,780.94	238.82	231.68	88.72	1,407.77
Per cent. of total miles of track	100.00	.02	.21	2.55	29.48	1.89	27.15	.11	.68	18.01	2.42	2.34	.90	14.24
Per cent. last year	100.00	.01	.21	1.48	30.46	2.36	23.82	.11	....	18.69	2.84	2.59	.91	16.52

At the Wood-preserving plants of the lines east of El Paso, 247,363 lineal feet of piling and 1,198,095 feet B. M. lumber were creosoted and 401,220 cross ties were burnettized; on the Pacific System lines, 307,450 lineal feet of piling and 943,070 feet B. M. lumber were creosoted, and 1,589,464 cross ties were burnettized.

Maintenance of Equipment.

	This Year.	Last Year.	Increase or *Decrease.*	Per Cent.
Locomotives	$5,848,394.35	$5,847,543.19	$851.16 +	.01
Passenger train cars	1,527,519.39	1,813,748.19	*286,228.80* —	15.78
Freight train cars	5,399,991.54	5,456,404.19	*56,412.65* —	1.03
Work equipment	323,629.58	427,404.46	*103,774.88* —	24.28
Floating equipment	341,903.62	354,362.01	*12,458.39* —	3.52
Equipment borrowed	.....	447,149.53	*447,149.53* —	100.00
Shop machinery and tools	298,856.08	434,351.91	*135,495.83* —	31.19
Superintendence	540,515.72	529,207.48	11,308.24 +	2.14
Other expenses	98,952.20	128,924.48	*29,972.28* —	23.25
Total	$14,379,762.48	$15,439,095.44	*$1,059,332.96* —	6.86

Decreases shown in *italics.*

$447,149.53 of the above decrease resulted from a change in the classification of operating expenses. In the revised classification of operating expenses as prescribed by the Interstate Commerce Commission, effective July 1, 1908, payments for "Equipment Borrowed" were eliminated as an item chargeable to operating expenses. These payments now appear as "Hire of Equipment" in the Income account.

The companies have not made any charge for "Depreciation" of equipment as contemplated by the Interstate Commerce Commission's new accounting regulations, but, as in the past, have charged to operating expenses (less salvage) the original cost (estimated, if not known) or purchase price of all equipment condemned, destroyed, sold, or vacated from any cause during the year. The amount thus charged is reported under the item of "Renewals", and amounted to $1,365,771.92, against $1,270,011.76 last year.

The average cost of repairs and renewals per locomotive and per car per annum, and the average number of serviceable locomotives and cars owned during the year were:

	Average Cost Per Annum. This Year.	Last Year.	Average Serviceable Number. This Year.	Last Year.
Locomotives, for repairs	$2,973.37	$3,089.70	....	....
for renewals	208.74	44.54	....	....
Total	$3,182.11	$3,134.24	1,846	1,818
Passenger train cars, for repairs	$910.33	$893.80	....	....
for renewals	51.90	71.77	....	....
Total	$962.23	$965.57	1,759	1,742
Freight train cars, for repairs	$103.65	$92.06	....	....
for renewals	19.05	23.39	....	....
Total	$122.70	$115.45	44,011	44,312

Traffic Expenses.

	This Year.	Last Year.	Increase or *Decrease.*	Per Cent.
Outside agencies	$857,529.16	$871,400.47	*$13,871.31* —	1.59
Advertising	414,008.69	402,682.64	11,326.05 +	2.81
Superintendence	571,942.87	665,188.36	*93,245.49* —	14.02
Other expenses	226,458.79	221,159.01	5,299.78 +	2.40
	$2,069,939.51	$2,160,430.48	*$90,490.97* —	4.19

Transportation Expenses.

	This Year.	Last Year.	Increase or *Decrease.*	Per Cent.
Locomotives, fuel for	$7,988,454.54	$9,362,016.98	*$1,373,562.44* —	14.67
Locomotive service other than fuel	6,453,241.74	7,480,442.29	*1,027,200.55* —	13.73
Train service	5,136,827.76	6,015,539.76	*878,712.00* —	14.61
Station and terminal service	8,222,464.62	9,350,313.22	*1,127,848.60* —	12.06

	This Year.	Last Year.	Increase or *Decrease.*	Per Cent.
Ferry and river service	$647,573.69	$641,521.66	$6,052.03	+ .94
Injuries, loss, damage and other casualties	2,709,161.05	3,282,100.41	*572,939.36*	—17.46
Superintendence	1,345,488.49	1,314,929.82	30,558.67	+ 2.32
Stationery and printing	287,355.07	287,607.82	*252.75*	— .09
Other expenses	55,626.04	69,728.62	*14,102.58*	—20.22
	$32,846,193.00	$37,804,200.58	*$4,958,007.58*	—13.11

Decreases shown in *italics.*

Southern Pacific Company. The new company acquired all the rights, property and franchises of the Cananea, Yaqui River & Pacific Railroad Company, and the several concessions granted by the Republic of Mexico to the Cananea, Yaqui River & Pacific Railroad Company and to the Southern Pacific Company.

Under these concessions there were completed during the year 251.74 miles of railway, a total of 783.85 miles completed to June 30, 1909, out of a total of 1,502.71 miles projected. The concession to the Southern Pacific Company provided for a subsidy of 12,500 pesos per kilometer (20,116 pesos per mile), payable in Five Per Cent. National Redeemable Debt Bonds of the Republic of Mexico up to the amount of five million pesos, which have been received. The remainder of the subvention will be paid in cash in ten annual payments without cause of profit, the first payment to be made six months after the respective line

AVERAGE NUMBER OF TONS OF FREIGHT PER TRAIN, OF LOADED CARS PER TRAIN (EXCLUDING CABOOSE), AND OF TONS PER LOADED CAR FOR YEAR.

Revenue and Company Freight. (Way Bill Tonnage.)	*Tons Per Train			Loaded Cars Per Train			Per Cent. of Loaded Car Mileage to Total Car Mileage.	Tons Per Loaded Car		
	Tons.	+ Increase. —Decrease. Tons.	Per Cent.	Cars.	+ Increase. —Decrease. Cars.	Per Cent.		Tons.	+ Increase. —Decrease. Tons.	Per Cent.
Lines east of El Paso	386.07	+53.32	16.03	19.05	+3.32	21.11	71.39 + 4.17	20.74	—.41	1.94
Lines west of El Paso	503.46	+55.34	12.35	24.42	+3.63	17.46	72.37 + 1.08	20.61	—.95	4.41
Average all lines	460.50	+57.12	14.16	22.43	+3.60	19.12	72.04 + 2.14	20.53	—.90	4.20
Average all lines June 30, 1901	305.34	—	—	17.57	—	—	71.97 —	17.38	—	—

*Ton miles per revenue freight train and all mixed train miles.

The decrease in expenses resulted from a reduction of about 14 cents per ton in the cost of fuel, and a decrease in the miles run by locomotives in revenue service, the result of a diminution in tonnage and better train loading. The congested traffic condition of the previous years had added greatly to the expenses for station and terminal service, but the return to normal conditions enabled the Company to effect large economies in this item of expense.

There was an increase in the number of loaded cars per train of 19.12 per cent. and in the number of tons per train of 14.16 per cent.

The work done by the transportation department of the rail lines is shown in the following table:

	+ Increase —Decrease	Per Cent.
Gross operating revenues	—$2,699,162.06	—2.38
Transportation expenses	—4,958,007.58	—13.11
Revenue passengers carried one mile	—98,823,855	—6.02
Mileage of passenger cars	—1,013,253	—.75
Locomotive mileage with passenger trains, including helping	—214,588	—.95
Tons of revenue freight carried one mile	—430,362,374	—6.64
Tons of revenue and company freight carried one mile	—631,009,095	—8.04
Mileage of freight cars	—38,949,329	—7.20
Locomotive mileage with freight and mixed trains, including helping	—3,742,534	—16.33
Total locomotive mileage in service for which the attendant expenses are charged to "Transportation Expenses"	—5,009,638	—9.58

The cost of fuel for locomotives per locomotive mile in revenue service for which the expenses are charged to transportation expenses was 16.895 cents per mile run against 17.813 cents in the preceding years and for the entire "Transportation Expenses" 69.489 cents against 77.420 cents in the preceding year.

which causes the subvention has been constructed and approved by the Secretary of Communications and Public Works.

The advances to the Southern Pacific Railroad Company of Mexico, after crediting against them the proceeds from the sale of the hereinbefore-mentioned bonds, amounted, on June 30, 1909, to $29,885,102.13.

The mileage projected under the concessions, the miles of railway completed, under construction, and remaining to be constructed, are as follows:

	Projected.	Constructed to June 30, 1909.	Remaining to be built: Under construction.	Remaining to be built: To be built.
Main line—				
Empalme to Guadalajara	852.69	594.43	86.02	172.24
Branch Lines	650.02	189.42	96.62	363.98
Total	1,502.71	783.85	182.64	536.22

Under the concessions to the Southern Pacific Company, 272.24 miles remain to be completed by November, 1912, and, under the concession to the Cananea, Yaqui River & Pacific Railroad Company, 446.62 miles to be completed by May, 1914.

In addition to the completed lines of railway reported under "Properties and Mileage" and the railway of the Southern Pacific Railroad Company of Mexico, hereinbefore referred to, construction is progressing on the following lines:

	Miles: Length of projected line.	Track completed.	Grading completed.	Grading progressing.
Inter-California Railway:				
Imperial Junction, California, to near Yuma, Arizona	95.48	91.23	....	....
Morgan's Louisiana & Texas R. R. & S. S. Co.:				
Lafayette to Port Allen, La.	52.57	41.45	....	8.62
Bayou Sale to South Bend, La.	10.63	10.45	....	....
Louisiana Western Railway:				
Eunice to Mamou, Louisiana	10.76	....	9.24	....

General Expenses.

	This Year.	Last Year.	Increase or *Decrease.*	Per Cent.
Salaries and expenses of general officers	$348,549.88	319,143.52	$29,406.36	+9.21
Salaries and expenses of clerks and attendants	1,643,814.51	1,740,447.79	*96,633.28*	—5.55
Law expenses	496,707.99	463,866.20	32,841.79	+7.08
General office expenses	219,599.13	256,623.38	*37,024.25*	—14.43
Stationery and printing	125,048.45	153,812.92	*28,764.47*	—18.70
Insurance	305,079.71	354,935.86	*49,856.15*	—14.05
Other expenses	224,044.75	229,702.09	*5,657.34*	—2.46
Total	$3,362,844.42	$3,518,531.76	*$155,687.34*	—4.42

Decreases shown in *italics.*

GENERAL.

There was appropriated during the year for additions, betterments, equipment, terminal property, and for the construction or acquisition of new lines, the sum of $45,102,422. The expenditures for account of these appropriations amounted to $31,044,830, leaving $14,057,592 unexpended, which amount has been brought over into the current fiscal year.

The concessions granted for the construction of certain lines in the Republic of Mexico, referred to in the last annual report, were, on June 24, 1909, transferred to the Southern Pacific Railroad Company of Mexico, a corporation incorporated in the State of New Jersey, with an authorized capital stock of $75,000,000, all of which is owned by the

Under the pension system, put into effect on January 1, 1903, there are carried on the pension rolls 421 employees. The payments to them for the year amounted to $152,307.60.

It is with sorrow announced to the stockholders that Mr. William D. Cornish, who has been a Director of this Company since April 9, 1902, and Vice-President since June 24, 1904, died on November 7, 1908; and that Mr. Edward H. Harriman, whose name is inseparably connected with this Company, died on September 9, 1909. The Board of Directors by suitable resolutions promptly recorded their appreciation of the character and service of each of these distinguished men and a copy of those relating to Mr. Harriman are appended to this report.

The accompanying report of the Comptroller shows fully and in

detail the financial and other transactions of the Southern Pacific Company and of the Proprietary Companies.

By order of the Board of Directors,

ROBERT S. LOVETT,
Chairman Executive Committee.

EDWARD H. HARRIMAN.

NEW YORK, September 14, 1909.

At a special meeting of the Board of Directors of the Southern Pacific Company held in the City of New York on the 14th day of September, 1909, the following tribute to the memory of Edward H. Harriman was unanimously adopted:

IN MEMORIAM

EDWARD HENRY HARRIMAN,

President, from September 26, 1901, and Chairman of Executive Committee Southern Pacific Company, from April 3, 1901, to September 9, 1909.

The Board of Directors of the Southern Pacific Company records with the deepest sorrow the death of Edward Henry Harriman at Arden, on the afternoon of September 9, 1909, in his sixty-second year.

Taken away in the prime of his life, at a time when in ordinary course he might have looked forward to many more years of accomplishment, he leaves a record of development and organization in railroad affairs without parallel, which will live as an important part of the industrial history of the country, a lasting monument to his memory.

In his death, not only the companies of which he was head, but the country as well, suffer irreparable loss, and we his friends and associates on the Board deeply mourn the death of friend and chief.

RESOLVED, that this brief tribute to his memory be inscribed upon the minutes of the Company, and that an engrossed copy be furnished to his family, to which the Board tenders its deep sympathy in their great sorrow.

A true copy.

Attest:

ALEX. MILLAR,
Secretary.

NO. 11—SOUTHERN PACIFIC COMPANY—ASSETS.

ASSETS.	June 30, 1909.	June 30, 1908.
Capital Assets—		
Stocks and bonds as shown in detail in Tables Nos. 12 and 13	$304,330,088 67	$316,565,379 67
Steamships	3,660,259 29	3,660,259 29
Sinking funds	594 00	144 00
	$307,990,941 96	$320,225,782 96
Current Assets—		
Cash	$31,783,013 42	$5,763,465 53
Demand loans and time deposits	11,450,000 00	.....
Loans and notes receivable	715,341 64	1,710,489 68
Agents and conductors	2,075,972 26	1,825,932 11
Income accrued to June 30th on securities owned	687,062 39	830,449 71
Individuals and companies	2,488,730 86	3,232,614 73
U. S. Government transportation	1,240,594 82	2,013,811 14
Material, fuel, and other supplies	9,561,451 26	10,541,985 09
	$60,002,166 65	$25,918,747 99
Deferred Assets—		
Advances for construction of new lines	$63,976,457 32	$44,310,194 11
Advances for acquisition of new lines and property	12,686,817 70	11,309,290 94
Advances for acquisition of electric lines	7,410,694 27	5,526,914 13
Rolling stock	10,257,687 40	18,424,446 67
Steamships and other floating equipment	7,913,267 05	7,900,951 96
Real estate and other property	16,561,634 89	15,081,566 27
Wood preserving plants	249,096 49	249,109 75
Individuals and companies	1,518,189 75	2,390,628 10
Advances for closing Colorado River Crevasse	3,769,866 36	3,518,152 65
	$124,343,711 23	$108,711,254 58
Proprietary Companies—		
Direct Navigation Co.	$36,704 98	$27,813 12
Galveston, Harrisburg & San Antonio Ry. Co.	10,502,434 45	10,870,265 53
Houston & Texas Central R. R. Co.	.....	686,213 64
Louisiana Western R. R. Co.	.....	40,745 29
Morgan's Louisiana & Texas R. R. & S. S. Co.	.....	298,049 96
Oregon & California R. R. Co.	6,435,863 90	7,741,965 77
Southern Pacific Terminal Co.	104,495 77	111,458 50
	$17,079,499 10	$19,776,511 81
Contingent Assets—		
San Antonio & Aransas Pass Ry. Co.	*$3,980,736 58	$3,981,007 97
Unadjusted accounts, Proprietary Company	228,652 65	114,490 75
	$4,209,389 23	$4,095,498 72
Total assets	$513,625,708 17	$478,727,796 06

*Includes $3,396,000, face value, San Antonio & Aransas Pass Ry. Co. Income Four Per Cent. Bonds, on which interest is payable on January 1, of each year, only if earned, out of net earnings and income.

NO. 11—SOUTHERN PACIFIC COMPANY—LIABILITIES.

LIABILITIES.	June 30, 1909.	June 30, 1908.
Capital Liabilities—		
Common stock	$213,910,358 64	$197,849,258 64
Preferred stock	58,626,400 00	74,863,300 00
Preferred stock—subscription receipts outstanding	365 00	3,163 00
First mortgage six per cent. steamship bonds, due January 1, 1911	1,715,000 00	1,786,000 00
Four per cent. gold bonds (Central Pacific Stock Collateral), due August 1, 1949	30,618,500 00	30,418,500 00
Two-five years four per cent. gold bonds, due June 1, 1910: Authenticated by trustee. $30,000,000 Less deposited with trustee. $5,223,000 Less in treasury .....17,524,000 — 22,747,000	7,253,000 00	7,253,000 00
Four per cent. Twenty-Year Convertible Gold Bonds	79,896,545 71	.....
Temporary receipts for Four and One-Half per cent. Twenty-Year Gold Bonds	72,000 00	.....
	$392,092,169 35	$312,173,221 64
Current Liabilities—		
Coupons matured—unpaid	$114,897 47	$125,332 47
Coupons due July 1	3,124,482 50	2,888,492 50
Interest accrued on bonds and loans to June 30, but not due	2,435,195 62	2,234,251 63
Dividends due—unpaid	54,523 20	59,764 96
Dividends due, July 1, 15, and Oct. 1	8,794,585 17	8,555,803 97
Bonds satisfied of mortgage but not presented	.....	1,000 00
Traffic and car service	651,200 62	958,393 76
Loans and notes payable	.....	52,472,648 26
Vouchers and pay rolls	7,950,119 46	6,899,476 64
	$23,125,004 04	$74,195,164 19
Deferred Liabilities—		
Pacific Mail Steamship Co.	$21,501 86	$60,675 22
Taxes assessed but not due	213,974 67	209,020 63
Wells, Fargo & Co.'s express contract	176,000 00	208,000 00
	$411,476 53	$477,695 85
Proprietary Companies—		
Central Pacific Ry. Co.	$4,746,879 06	$4,238,359 59
Houston, East and West Texas Ry. Co.	227,280 41	13,807 99
Houston & Shreveport R. R. Co.	68,799 37	23,240 27
Houston & Texas Central R. R. Co.	351,486 20	.....
Louisiana Western R. R. Co.	76,422 97	.....
Morgan's Louisiana & Texas R. R. & S. S. Co.	70,964 41	.....
Nevada & California Ry. Co.	90,996 84	55,947 02
Southern Pacific R. R. Co.	34,862,690 93	26,597,509 41
Texas & New Orleans R. R. Co.	851,955 54	621,240 56
	$41,347,475 73	$31,550,104 84
Contingent Liabilities—		
Marine insurance fund	$3,186,137 15	$3,195,687 63
Steamship insurance fund	1,607,697 54	1,607,697 54
Floating equipment replacement fund	4,694,006 36	3,955,462 65
Rolling stock replacement fund	293,597 88	208,462 71
Reserve for depreciation of rolling stock	866,996 10	2,502,164 52
Insurance fund	131,305 50	32,630 45
Unadjusted claims and accounts	2,346,496 48	1,915,918 16
Individuals and companies	76,253 19	4,059 28
Principal of deferred payments on land contracts	128,927 98	141,061 62
	$13,331,418 18	$13,563,144 56
Total liabilities	$470,307,543 83	$431,959,331 08
Balance to credit of profit and loss	43 318,164 34	46,768,464 98
Total liabilities	$513,625,708 17	$478,727,796 06

NO. 12—SOUTHERN PACIFIC COMPANY—STOCKS OWNED—JUNE 30, 1909.

Proprietary Companies.*	Total issued and outstanding June 30, 1909.	Total owned by Southern Pacific Company.	Distribution of Stocks owned by Southern Pacific Company. Deposited against issue of S. P. Co. Common Capital Stock.	Deposited under S. P. C. 2-5 Years 4 Per Cent. Mortgage.	Total Amount Deposited.	Amount Free.
Central Pacific Ry. Co.—Common	$67,275,500.00	$67,275,500.00	....	$67,274,200.00‡	$67,274,200.00	$1,300.00
Central Pacific Ry. Co.—Preferred	13,800,000.00	13,800,000.00	....	13,800,000.00‡	13,800,000.00	....
Direct Navigation Co	50,700.00	200.00	....	....	....	200.00
Galveston, Harrisburg & San Antonio Railway Co	27,084,372.00	27,056,600.00	27,005,600.00	....	27,005,600.00	51,000.00
Houston, East & West Texas Ry. Co.	1,920,000.00	1,918,200.00	....	1,905,000.00	1,905,000.00	13,200.00
Houston & Shreveport R. R. Co	400,000.00	397,600.00	....	395,000.00	395,000.00	2,600.00
Houston & Texas Central R. R. Co	10,000,000.00	9,998,300.00	....	9,996,000.00	9,996,000.00	2,300.00
Louisiana Western R. R. Co	3,360,000.00	3,360,000.00	3,310,000.00	....	3,310,000.00	50,000.00
Morgan's Louisiana & Texas R. R. & S. S. Co	15,000,000.00	15,000,000.00	4,994,000.00	10,000,000.00	14,994,000.00	6,000.00
Nevada & California R. R. Co	4,425,700.00	4,425,700.00	....	4,380,000.00	4,380,000.00	45,700.00
Oregon & California R. R. Co.—Com.	7,000,000.00	6,970,198.50	....	6,945,000.00	6,945,000.00	25,198.50
Oregon & California R. R. Co.—Pfd.	12,000,000,00	11,991,000.00	....	11,980,000.00	11,980,000.00	11,000.00
South Pacific Coast Ry. Co	6,000,000.00	6,000,000.00	....	....	....	6,000,000.00
Southern Pacific R. R. Co	160,000,000.00	160,000,000.00	123,619,033.00	9,088,000.00	132,707,033.00	27,292,967.00
Southern Pacific Terminal Co	2,000,000.00	1,999,600.00	....	1,995,000.00	1,995,000.00	4,600.00
Texas & New Orleans R. R. Co	5,000,000.00	4,999,500.00	4,997,500.00	....	4,997,500.00	2,000.00
Total Proprietary Companies	$335,316,272.00	$335,192,398.50	$163,926,133.00	$56,684,000.00	$301,684,333.00	$33,508,065.50
Other Companies.						
Associated Oil Co	$40,000,000.00	$20,069,003.00	....	....	....	$20,069,003.00
Beaver Hill Coal Co	500,000.00	500,000.00	....	....	....	500,000.00
Cananea, Yaqui River & Pacific R. R. Co	....	....				
Central California Ry. Co	30,000.00	30,000.00	....	....	....	30,000.00
Coast Line Ry. Co	100,000.00	100,000.00	....	....	....	100,000.00
Coos Bay, Roseburg & Eastern R. R. & Navigation Co	2,000,000.00	2,000,000.00	....	....	....	2,000,000.00
Corvallis & Eastern R. R. Co	1,410,000.00	1,410,000.00	....	....	....	1,410,000.00
Gila Valley, Globe & Northern Ry. Co.	2,000,000.00	2,000,000.00	....	$1,997,000.00	$1,997,000.00	3,000.00
Goose Lake & Southern Ry. Co	....	....				
Independence & Monmouth R. R. Co	25,000.00	12,750.00	....	....	....	12,750.00
Inter-California Ry. Co	216,000.00	216,000.00	....	....	....	216,000.00
Kern Trading & Oil Co	1,000,000.00	1,000,000.00	....	....	....	1,000,000.00
Lincoln Northern Ry. Co	11,200.00	11,200.00	....	....	....	11,200.00
Los Angeles Ry. Co	5,000,000.00	2,250,000.00	....	....	....	2,250,000.00
Maricopa & Phoenix R. R. Co	1,000,500.00	1,000,500.00	....	500,000.00	500,000.00	500,500.00
Merced Canon Ry. Co	100,000.00	50,000.00	....	....	....	50,000.00
Mexican International R. R. Co	....	4,172,100.00	4,164,100.00	....	4,164,100.00	8,000.00
Northwestern Pacific R. R. Co	35,000,000.00	17,500,000.00	....	....	....	17,500,000.00
Oroville & Nelson R. R. Co	13,000.00	13,000.00	....	....	....	13,000.00
Pacific Electric Ry. Co	20,000,000.00	10,000,000.00	....	....	....	10,000,000.00
Pacific Fruit Express Co	10,800,000.00	5,400,000.00	....	....	....	5,400,000.00
Pacific Mail Steamship Co	20,000,000.00	10,010,000.00	....	10,005,000.00	10,005,000.00	5,000.00
Rio Bravo Oil Co	850,000.00	849,500.00	....	....	....	849,500.00
Rubicon Water & Power Co	500,500.00	500,500.00	....	....	....	500,500.00
Sacramento Southern R. R. Co	100,000.00	100,000.00	....	....	....	100,000.00
San Bernardino & Redlands R. R. Co	200,000.00	200,000.00	....	....	....	200,000.00
San Francisco & Napa Ry. Co	55,000.00	55,000.00	....	....	....	55,000.00
Southern Pacific Co.—Common	213,910,358.64	137,953.34	....	....	....	137,953.34
Southern Pacific Co.—Preferred	....	....				
Southern Pacific R. R. Co. of Mexico	75,000,000.00	75,000,000.00	....	....	....	75,000,000.00
Sunset R. R. Co	500,000.00	250,000.00	....	248,500.00	248,500.00	1,500.00
Wells Fargo & Co.'s Express	8,000,000.00	1,530,000.00	....	....	....	1,530,000.00
Stocks of other Oil Companies	....	1,566,644.40	....	....	....	1,556,644.40
Stocks of Land and Town Sites Comp's	....	106,666.66	....	....	....	106,666.66
Stocks of Miscellaneous Companies	....	1,198,620.00	....	....	....	1,198,620.00
Total Other Companies	....	$159,239,437.40	$4,164,100.00	$12,750,500.00	$16,914,600.00	$142,324,837.40
Total	....	$494,431,835.90	$168,090,233.00	$69,434,500.00	$318,598,933.00§	$175,832,902.90
Asia Steamship Co	£100	£100	....	....	....	£100
Persia Steamship Co	£100	£100	....	....	....	£100

*Companies whose revenues and expenses, transportation and traffic statistics are embraced in the accompanying statements for "Proprietary Companies."

‡Deposited Under S. P. Co. 4 per cent. (C. P. stock collateral) mortgage, totals $81,074,200. Is not included in the total of this column. [See also following note (§)]. §Include the $81,074,200 of common and preferred of Central Pacific Ry. Co., referred to in previous note. (‡).

NO. 14.—PROPRIETARY COMPANIES—INCOME ACCOUNT—YEAR ENDED JUNE 30, 1909.

Receipts.	Total.
Gross operating revenues and revenues from outside operations	$112,722,229.23
Rentals for lease of road	25,000.00
Hire of equipment	38,412.01
Rentals for joint tracks, yards, and terminal facilities.	338,377.70
Miscellaneous rentals	24,511.12
Income from investments	173,840.00
Income from lands and securities not pledged for redemption of bonds	821,858.12
Income from sinking fund investments	205,800.00
Interest on open accounts	1,288,641.04
Interest on loans and advances other than on open accounts with S. P. Co. and Proprietary Companies	500.77
Miscellaneous income	60,177.50
Total receipts	$115,699,347.49
Expenditures.	
Operating expenses and expenses of outside operations	$68,750,509.68
Taxes	3,772,057.15
Rentals for lease of road	$877,108.67
Hire of equipment	1,929,947.51
Rentals for joint tracks, yards, and terminal facilities.	150,862.85
Miscellaneous rentals	748.27
Interest on funded debt	15,303,100.39
Interest on open accounts	1,169,982.78
Interest on loans and advances other than on open accounts with S. P. Co. and Proprietary Companies.	20,122.77
Land department expenses	125,661.12
Taxes on granted lands	246,181.00
Sinking fund contributions and income from sinking fund investments	497,800.00
Additions and betterments	405,276.78
Miscellaneous expenses	54,934.68
Total expenditures	$93,304,293.65
Balance surplus	$22,395,053.84
Balance deficit	....
Deficit payable by Southern Pacific Company	859,686.82
Net earnings payable to Southern Pacific Company	2,479,119.05
Balance to profit and loss (Table No. 15) surplus	$20,775,621.61

NO. 15.—PROPRIETARY COMPANIES—PROFIT AND LOSS ACCOUNT—YEAR ENDED JUNE 30, 1909.

Credit.	Total.	Debit.	
Balance June 30, 1908	$68,929,697.14	Balance June 30, 1908	$5,914,218.55
Adjustment in leasehold operations years 1905 and 1906	3,229,935.71	Uncollectible accounts written off	6,738.31
Income account—surplus (Table No. 14)	20,775,621.61	Adjustments in unsettled claims and accounts	30,936.45
Proceeds from sale of unpledged lands	199,398.49	Dividends on preferred stock	548,000.00
Proceeds from sale of lands pledged for the redemption of bonds	940,333.02	Dividends on common stock	13,613,640.00
Collection of old accounts	5,643.81	Discount on bonds issued during the year	1,383,586.84
Annual payments to sinking funds and income from sinking fund investments	497,800.00	Fund for refunding outstanding old bonds of S. P. R. R. Co.	1,500,000.00
Adjustments in unsettled claims and accounts	7,697.85	Rental for Bay Shore Line for the year 1908	254,576.28
Balance to debit of general account, June 30, 1909	3,856,415.54	*Balance to credit of general account, June 30, 1909*	75,190,846.74
		(Net balance to credit of general account, June 30, 1909, $71,334,431.20.)	
Total	$98,442,543.17	Total	$98,442,543.17

NO. 13.—SOUTHERN PACIFIC COMPANY—BONDS OWNED—JUNE 30, 1909.

	Total issued and outstanding June 30, 1909.	Total owned by Southern Pacific Company.	Distribution of Bonds owned by Southern Pacific Company. Deposited against issue of S. P. Co. Common Capital Stock.	Deposited under S. P. Co. 2-5 Years 4 Per Cent. Mortgage.	Total Amount Deposited	Amount Free.
Proprietary Companies*						
Carson & Colorado Ry. Co. first mortgage 4 per cent	2,000,000.00	2,000,000.00	....	2,000,000.00	2,000,000.00	....
Central Pacific Ry. Co. first refunding mortgage 4 per cent	....	....				
Central Pacific Ry. Co. 3½ per cent. mortgage	....	....				
Central Pacific Ry. Co. Through Short Line, first mortgage 4 per cent	9,640,000.00	1,340,000.00	....	....	....	$1,340,000.00
Galveston, Harrisburg & San Antonio Ry. Co. second mortgage, Eastern Division 6 per cent	....	....				
Galveston, Harrisburg & San Antonio Ry. Co. equipment 6 per cent	1,558,000.00	1,558,000.00	....	1,230,000.00	1,230,000.00	328,000.00
Galveston, Harrisburg & San Antonio Ry. Co. second mortgage M. & P. Extension 6 per cent	6,354,000.00	1,110,000.00	....	1,110,000.00	1,110,000.00	
Galveston, Houston & Northern Ry. Co. first mortgage 5 per cent	800,000.00	800,000.00	....	800,000.00	800,000.00	
Gulf, Western Texas & Pacific Ry. Co. first mortgage 5 per cent	2,224,000.00	2,224,000.00	....	2,224,000.00	2,224,000.00	
Houston & Shreveport R. R. Co. first mortgage 6 per cent	150,000.00	150,000.00	....	150,000.00	150,000.00	
Houston & Texas Central R. R. Co., Lampasas Extension, first mortgage 5 per cent	450,000.00	425,000.00	....	425,000.00	425,000.00	
New York, Texas & Mexican Ry. Co. first mortgage, Matagorda Division, 6 per cent	842,000.00	548,000.00	....	548,000.00	548,000.00	
Oregon & California R. R. Co.'s first mortgage 5 per cent	17,745,000.00	32,000.00	....	....	....	32,000.00
Southern Pacific R. R. Co.'s first consolidated mort. 5 per cent. of 1893	4,127,500.00	243,000.00	....	....	....	243,000.00
Southern Pacific R. R. Co. first mortgage 6 per cent. of 1875	....	....				
Southern Pacific R. R. Co. first refunding mortgage 4 per cent	....	....				
Texas & New Orleans R. R. Co. first mortgage, Main Line, 6 per cent	862,000.00	561,000.00	....	561,000.00	561,000.00	
Texas & New Orleans R. R. Co. first mortgage, Dallas Div. 4 per cent.	3,997,000.00	1,190,000.00	....	1,190,000.00	1,190,000.00	
Texas & New Orleans R. R. Co. equipment 6 per cent	476,000.00	476,000.00	....	476,000.00	476,000.00	
Total Proprietary Companies	....	$12,657,000.00	....	$10,714,000.00	$10,714,000.00	$1,943,000.00
Other Companies.						
Associated Oil Co. first mortgage 5 per cent	$2,833,000.00	$750,000.00	....	....	....	$750,000.00
Calexico School District 6 per cent	....	3,000.00	....	....	....	3,000.00
Coos Bay, Roseburg & Eastern R. R. Nav. Co. first mortgage 6 per cent.	625,000.00	625,000.00	....	....	....	625,000.00
Corvallis & Eastern R. R. Co. first mortgage 4 per cent	1,410,000.00	1,410,000.00	....	....	....	1,410,000.00
Los Angeles Interurban Ry. Co. first mortgage 5 per cent	9,020,000.00	4,510,000.00	....	....	....	4,510,000.00
Los Angeles Pacific Co., general consolidated mortgage 5 per cent	5,784,000.00	893,000.00	....	....	....	893,000.00
Mexican Consolidated Public Debt 3 per cent.	....	†12,300.00	....	....	....	†12,300.00
Northwestern Pacific R. R. Co. first refunding mortgage 4½ per cent	5,694,000.00	5,694,000.00	....	....	....	5,694,000.00
Northern Pacific Terminal Co. first mortgage 6 per cent	3,470,000.00	5,000.00	....	....	....	5,000.00
Pacific Electric Ry. Co. first mortgage 5 per cent	8,494,000.00	770,000.00	....	....	....	770,000.00
Riverside & Arlington R. R. Co. first mortgage 4 per cent	200,000.00	140,000.00	....	....	....	140,000.00
San Jose-Los Gatos Interurban Ry. Co. first mortgage 5 per cent	500,000.00	50,000.00	....	....	....	50,000.00
Silsbee School District 6 per cent	....	2,500.00	....	....	....	2,500.00
Southern Pacific Co. (C. P. Stock Collateral) 4 per cent	30,618,500.00	1,849,000.00	....	$1,835,000.00	$1,835,000.00	14,000.00
Sunset R. R. Co. first mortgage 4 per cent	316,000.00	158,000.00	....	142,000.00	142,000.00	16,000.00
U. S. of Mexico Redeemable Internal Debt 5 per cent	....	†5,000,000.00	....	....	....	†5,000,000.00
Bonds of other companies	....	3,149,600.00	....	....	....	3,149,600.00
Total other Companies	....	$25,021,400.00	....	$1,977,000.00	$1,977,000.00	$23,044,400.00
Total Bonds	....	$37,678,400.00	....	$12,691,000.00	$12,691,000.00	$24,987,400.00
Total Stock (Table No. 12)	....	494,431,835.90	$168,090,233.00	69,434,500.00	318,598,933.00§	175,832,902.90
Total Stocks and Bonds	....	$532,110,235.90	$168,090,233.00	$82,125,500.00	$331,289,933.00	$200,820,302.90

*Companies whose revenues and expenses, transportation and traffic statistics are embraced in the accompanying statements for "Proprietary Companies." †Mexican Currency.

§ Includes the $81,074,200 of common and preferred stock of the Central Pacific Ry. Co., see note (‡) under Table 12.